PRACTICAL NURSING

By AMY ELIZABETH POPE

ESSENTIALS OF DIETETICS

A QUIZ BOOK FOR NURSES

ANATOMY AND PHYSIOLOGY FOR NURSES

(With Anna Caroline Maxwell)
PRACTICAL NURSING

Practical Nursing

A Text-Book for Nurses

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PREFACE FOR REVISED EDITION

THE methods of work described in this and former editions of *Practical Nursing* are those which I have seen used in various hospitals. For the revision of the portions of the book dealing with bacteriology, physiology, and disease, I have consulted lecture notes, recent issues of many of the leading medical journals, and nearly all the books mentioned in the list at the end of this volume. My thanks are due to Miss Louise M. Marsh, head nurse of the Presbyterian Hospital operating room, for her assistance with the revision of the chapter on Operating-Room Technique; to Miss Isabel M. Stewart, of the Nursing and Health Department of Teachers College, Columbia University, for many valuable suggestions; and to the publishers for their assistance in the preparation of the book.

AMY E. POPE

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Practical Nursing

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Moral Qualifications: Courtesy, Dignity, Economy, Obedience, Patience, Promptness, Self-control, Sympathy, Tact, Truthfulness, Unselfishness.

Professional Etiquette. Professional Ethics. The Florence Nightingale Pledge.

WOMEN who contemplate entering the profession of nursing should give the matter careful consideration, gathering from available sources an intelligent idea of the requirements, the trials, the hardships, and the reward of such exacting work. Women not naturally adapted for the work are almost sure to find it irksome, or, at best, to regard it simply as a means of earning a livelihood and thus miss its most inspiring features. On the other hand, to those who possess the necessary qualifications, nursing offers a life of unusual interest and usefulness. To

the inquiring and intelligent student, it opens a wide range of knowledge and unlimited means for self-development, and it also provides rare opportunities to help others. But it will be found that mere sentimentality will be completely discouraged when subjected to the test of the arduous and monotonous routine of this essentially practical work.

The qualifications necessary for the making of a good nurse may be considered under three heads: physical, mental, and moral.

Physical Qualifications

The indispensable physical qualifications are: health, strength, and endurance. Unless a woman be possessed of perfect health, a strong constitution, unlimited physical endurance, and freedom from an excessively high nervous organization, she cannot give of her best to this work. The reactions between the physical and mental conditions are so closely connected that the life of a nurse becomes unendurable when she is physically depleted, and consequently she fails to give to the patients either the bodily or mental help which they require.

Means of Maintaining Health.—To preserve a sound physical condition in spite of hard work and constant exposure to disease, strict obedience must be paid to the laws of hygiene; especially, personal cleanliness, the wearing of suitable clothing, the securing of an adequate amount of fresh air, of sufficient rest, the avoidance of causes of indigestion, and early attention to all slight ailments.

Cleanliness.—Cleanliness is at all times important as a preventive of disease, but in the hospital, where

pathogenic germs are undoubtedly present in far larger numbers than in other places, the need for absolute cleanliness is increased a hundred-fold.

1. A daily bath is indispensable, not only as a matter of cleanliness, but also for its tonic effect upon the skin. A warm bath followed by a cold shower is usually considered the most effective.

2. *The Hair* should be thoroughly washed every two weeks, and well brushed every night. Nature supplies an oil for the purpose of keeping the hair soft and pliable. When this oil is present in excess, which it will be unless the hair is washed regularly, it attracts dust and germs, and thus may become a fruitful source of contagion. While on duty the hair should be worn brushed back from the face and dressed in a simple manner.

3. *The Teeth* should be always brushed and *the throat gargled* at least twice a day; but when caring for a patient with an infectious disease, it is imperative that this should be done before every meal and before retiring for the night. It is advisable to have the teeth examined by a dentist twice a year, as teeth in a bad condition will impart a fetid odor to the breath and may be the cause of indigestion.

The Care of the Hands is of the utmost importance; negligence in this matter frequently endangers not only the life of the nurse who is careless, but also that of her patients and fellow-workers. After handling a patient who is suffering from an infectious disease, the hands should be disinfected before touching anything—*even before washing them*—by submerging and *scrubbing them* in a disinfectant for three minutes. Furthermore, in order that they may be easily disinfected they must be kept in good

condition: (1) by using forceps, whenever practicable, to handle dressings and other infected materials, etc.; (2) by rinsing the hands between the use of the soap and disinfectant and wiping them perfectly dry after cleansing; (3) by applying, after washing, some lubricating hand wash; also rubbing in at night a reliable ointment or cold cream. This care is necessary since the constant use of water and disinfectants has a tendency to roughen the skin. (4) The hands should be well washed before each meal and before retiring.

The finger nails should receive careful attention, as they form a convenient hiding-place for germs. The cuticle should be cleaned frequently, even when it does not appear dirty, and the nails should be polished and kept short. To prevent infected fingers, a constant watch must be kept for hangnails, scratches, and cuts; the latter should be protected with flexible collodion, or, if of any size, with sterile gauze.

Suitable Clothing.—The clothing should not only be scrupulously clean, but the underclothing, dress-shields, and uniform must be changed often enough to secure a desirable freshness. Perfumes should never be used on the clothing, because when working over a patient a nurse is brought in very close contact, and perfumes are often distasteful to the sick.

To insure comfort and give perfect freedom of motion, clothing must be neither too tight nor too loose.

This is specially true of corsets and footwear. Well-fitting shoes are of the utmost importance, for, as nurses have to do so much standing and walking, unsuitable shoes are likely to cause the condition known as *flat foot* and many minor, but annoying,

evils as corns, bunions, etc. No exact description of a perfect shoe for nurses can be given; what is suitable for one person may not be for another, but there are certain important requisites for shoes for hospital wear: the shoe must be of good quality; the upper part should be soft and pliable; the soles should be of medium weight, they must not be too light or callous spots will develop on the soles of the feet of the wearer; the heels should be as low as can be worn with comfort, they should always be broad and furnished with a half-inch rubber tip. Nurses who have difficulty in getting shoes wide enough in front to give the toes free play without slipping at the heels should wear kid heel protectors in their shoes. Sometimes, especially when they first come to the hospital, nurses' feet perspire a great deal; when this is the case the shoes and stockings should be changed twice a day. Odor due to perspiration can often be corrected by the use of borax or other alkaline powder in the shoes, and washing the feet frequently with laundry soap, or formaldehyde solution, 1 per cent., has also been found effectual.

Fresh Air and Exercise.—Nothing is more conducive to good health than fresh air. Nurses should always sleep with their windows open, winter and summer. They should spend at least a part of their time off duty out-of-doors. No amount of exercise indoors will take the place of a walk in the open air.

Sleep and Recreation.—Too much stress cannot be laid on the need of rest. At least seven hours' sleep is required in order to keep well and to do good work, therefore recreation should not frequently be allowed to shorten the hours intended for sleep. At

the same time, nurses need a diversity of interests, in order to keep their minds alert and enable them to provide entertainment for their patients. In many instances, when on private duty, the latter is imperative. A certain amount of amusement is, therefore, exceedingly necessary, and should be indulged in as far as possible without causing fatigue.

Causes likely to Result in Indigestion.—The habit of rapid eating with insufficient mastication, and the use of unwholesome and indigestible food after a hard day's work in hospital wards, are frequent causes of indigestion among nurses. Only in cases of extreme emergency do the hospital authorities expect nurses to shorten the time allowed them for their meals, but, owing to the rapidity with which they are in the habit of working and the fact that, frequently, when they come to their meals they are harassed with the thought of work yet to be done, nurses are apt to acquire the habit of eating quickly. They should, therefore, try to forget their work, done or undone, when they come to their meals. At first this seems an utter impossibility, but the brain can, and should, be trained as well as the fingers. All "ward talk" should be avoided at meal-time; discussions of patients or hospital work should not then be tolerated. Instead, the effort should be made to direct the conversation to interesting topics of the day, and amusing incidents that will divert the mind into new channels of thought.

Attention to Slight Ailments.—Serious illness may often be prevented by attending immediately to such slight ailments as indigestion, constipation, sore throat, to any appearance of infected fingers, and, what is particularly common among nurses, the

breaking down of the arch of the foot. Student nurses should not attempt to prescribe for themselves, as indiscriminate dosing often begets the "drug habit." Those in authority in a school of nursing are responsible for the health of the students; it is due to them, therefore, that they be informed of any tendency to disease. Students must not, however, expect to be off duty for slight ailments. If they wish to become useful and successful nurses they must accustom themselves to working under difficulties.

Mental Qualifications

Education.—The acquirements of the higher education, although always desirable, are not absolutely necessary for the success of the probationer, but women wishing to prepare for such responsible work as nursing must present evidence of a high order of intelligence and of a desire to learn. In the practice of their profession, nurses will find that there is no knowledge, even of subjects far remote from nursing, which may not prove useful, and intelligent students will soon realize how important it is to know thoroughly the underlying principles governing their work. A liberal education is particularly useful to those who undertake private nursing, because it fits them to enter into the interests of their patients and to become resourceful companions, able to brighten the tedious hours of convalescence. Intelligent reading aloud, in a well modulated voice, will form, in many instances, a large part of necessary entertainment, and nurses should prepare themselves to meet this ever-increasing requirement.

Judgment.—Judgment is the faculty of being able

to decide what is best to do or say under certain conditions, and a nurse's intelligence should be so keen that when two conditions are placed before her, she can weigh them quickly and decide the relative value of each to the matter in hand. Those who have never held responsible positions are apt to fail at first in this respect, but by always observing wherein their decisions have erred, they can profit by their failures. Women devoid of this quality are likely to create difficulties for themselves and others.

Memory.—A good memory is a most important possession and one which the majority of people lack, and lack from want of cultivation. The habit of writing everything down helps one to remember, but it does not help the memory. To improve the memory one must give it constant practice. To cultivate the memory one requires (1) to learn to concentrate the attention, (2) to acquire the habit of (*a*) frequently recalling things to be remembered to the mind, and (*b*) of forming several mental associations with the things to be remembered that will help in recalling them; for the probability of remembering a thing depends upon (1) the strength of the original impression on the mind and (2) the number of associations which will recall it to mind.

Order.—Nurses must learn to cultivate an orderly mind and orderly habits. To attain the first they should make an inventory every morning of their day's work, and determine how long each task will take and the sequence in which it had better be performed. Paying attention to this routine will obviate needless expenditure of mental and physical strength, and will assist in acquiring an orderly method of working which is essential. Nurses should

not tolerate any form of disorder in the things about them, or allow confusion where they are working. They should also strive to acquire the power of making their work look finished. It is hard for some people to do this, and those who find it so should take particular care in doing such work as folding linen, or gauze, for dressings, to make all piles perfectly even, corners square, etc. This takes time, but, with attention, the knack and rapidity are soon acquired. The most important point of order is that there should be "a place for everything and everything in its place." Great indeed must be the emergency which will excuse putting anything where it does not belong. Failure to find important instruments, etc., in place and in order may cost a life.

Perception.—Perception is probably the mental faculty that requires the most constant practice in nursing. Nurses must be quick to observe minute details and equally quick to act intelligently on their observations. They must note instantly any unfavorable change in a patient's mental or physical condition, since the failure to do so might result in his death. If a patient's position becomes uncomfortable, if his pillows are out of place, if he is exposed to a draught, or if a light be shining in his eyes, the nurse should perceive it at once. If noise or too prolonged visits of friends are annoying the patient, these should be perceived and prevented. Quick perception will save loss of much valuable time and many reproofs. When assisting at a treatment or operation, a nurse who possesses this gift will notice what is required and anticipate the doctor's wants; when instruction regarding a specific piece of work

is being given, she will notice details and so obviate the necessity of repetition.

Promptness.—Nurses must learn to move and work quickly but quietly—to make haste without hurry. This is necessary for at least two reasons: (1) patients are apt to become tired if too much time is consumed in carrying out their treatments or making their toilets; (2) nurses who are not prompt and quick under ordinary circumstances are apt to be sadly wanting in emergencies.

Moral Qualifications

Courtesy—which is defined as showing "a well-bred consideration for others founded on kindness"—is especially essential in dealing with the difficult questions which arise in connection with patients and their friends. Frequent complaint is made against nurses because of their brusque manner and their unwillingness to give information regarding their patient's condition. The former is often due to press of work, and even women well versed in the essentials of good manners are, when busy, apt to be guilty of discourtesies. This tendency should therefore be kept in mind and carefully guarded against. For various reasons it is often unadvisable for a nurse to give information regarding patients. When such is the case, inquirers should be referred to the doctor, but this should be done in such a way as to give the impression that the information is withheld, not from unwillingness to give it, but because it had better come from a higher authority. When dissatisfaction arises, a nurse should never engage in argument, but refer the patient or his friends to the proper authority.

When met with irritation, fault-finding, and unjust criticism, remember "the gentle answer that turneth away wrath."

Dignity.—The very nature of the office demands that a nurse be quiet and dignified in manner. If she is cordial without being familiar with patients and co-workers, they will have a greater respect for her and be more ready to give prompt and willing obedience. Any display of irritation or loss of temper, no matter what the provocation, is inexcusable, and tends to impair her dignity and lessen her influence. Genuine dignity admits of no rudeness or familiarity from others, but at the same time it is free from any display of personal importance or superiority. Also, it must be remembered that the hospital ward is no place for social intercourse or amusement. Any frivolity or undignified behavior is sure to call forth adverse criticism, for there are always those who will criticize, and unfortunately, as a rule, these critics class the whole nursing profession with the individual offender.

Economy.—Extravagance is, under all circumstances, to be deplored, but in the hospital where money is given with the expectation that it is to be utilized to the fullest extent for the benefit of the sick, and in homes where the necessary expenses of illness are sorely felt, it is a crime. Nurses should learn the comparative cost of supplies, and utilize the minimum quantity of the cheapest that is consistent with the requirements. Disinfectants, for example, are expensive, and while they must be used in sufficient quantity to be efficacious, to use more than is required is wasteful.

Frequent complaint comes from private homes,

even of nurses who are otherwise satisfactory, because of their needless extravagance in the use of supplies and linen, and their destruction of the varnish of valuable furniture by the careless use of heat and chemicals. Accidents will happen, even with the best of care, therefore nurses should know how to remove stains from linen, etc.—this will be described in Chapter IV—and, when possible, they should move valuable furniture and rugs from the neighborhood of where they are working, if there is any chance of splattering them with water or other substance, and it is usually well to have a cover on the table at the bedside and a rubber, or other protector, under the cover.

Obedience.—No woman should take up nursing who is not willing to give prompt, unquestioning, and intelligent obedience to authority. Women are not admitted to schools of nursing until they are twenty-one years of age; they enter then of their own free will, therefore there can be no excuse for disobedience. In hospitals, the rules are necessarily very strict, because the highest order of discipline must be obtained, it being impossible to manage such institutions on any other basis. Obedience includes not only the keeping of rules, but also the absolute carrying out of orders regarding the care of patients and detail of work.

Patience.—Constant exercise of patience, avoiding any display of impatience, is important. Intolerance with the sick will be readily avoided by remembering that their mental condition is probably such that they are not responsible for their words or actions. Neither should nurses be unjustly impatient with those whom they have to direct, for often apparent

stupidity in others is really due to lack of sufficiently explicit directions.

Personal Neatness.—The Uniform: Nurses should always be immaculately clean, trim, and tidy. An untidy appearance gives the impression of carelessness, and carelessness is a characteristic that is not tolerated in a nurse. Jewelry and other forms of adornment should not be worn *when in uniform*. The nurse's uniform is, as it were, her passport to scenes and places from which other people are excluded and in which an impersonal, professional, dignified bearing is essential, and ribbons and jewelry are not in keeping with the impression that the uniform is intended to create.

Self-Control.—The emergencies and trying experiences which nurses have constantly to meet, call for cool heads and steady nerves. They must, therefore, learn how to become well poised women: to master their emotions, to avoid display of feeling at the wrong moment in order to be ready for prompt action. In the case of protracted and distressing illness exceptional self-control and fortitude are often required to go on day by day, unaffected by the sight of suffering and weakness, or the irritability and ingratitude of patients who have become self-centered.

Sympathy.—The claim is often made that familiarity and continued contact with the sick hardens the nurse and detracts from her power to feel or give out sympathy. On the contrary, this intimate knowledge of the suffering of others will develop in the womanly woman an intelligent, true, and tender sympathy. This may be shown by the gentle touch, the cheering smile, or the encouraging word of which patients are often sadly in need. By contrast, the

nurse must also learn not to allow her sensitiveness to pain and suffering to deter her from carrying out orders, however painful, that may benefit the patient. This must be done, however, with such tenderness that he will not fail to realize that his suffering is being considered, and the treatment only carried out for his good.

TACT has been defined as *the power of doing and saying the right thing at the right moment.* Comparatively few persons are born with this gift, but fortunately it can, and, therefore, should be cultivated. Only those who are tactful can really control and manage others, or inspire them to do their best. The daily requirements of the hospital ward offer a wide field for the exercise of tact, and it is here that the nurse finds a rare opportunity for the cultivation of this quality. In private nursing, tact is often required in such little matters as appreciating when to be present and when to retire, when to speak and when to be silent, and to gain the co-operation of the family in order to do all that is required for the patient's benefit.

TRUTHFULNESS.—It must be borne in mind that in nursing truthfulness takes on a very broad meaning. There, it means not only an unwillingness to tell a downright untruth, but also the possession of an honesty of purpose that will lead to the frank acknowledgment of an error and the prompt confession of anything that has been left undone. It means also absolute accuracy of statement, avoiding all exaggeration, and, especially, the conscientious performance of all minute details which have been considered necessary in constructing routine procedures, whether their omission is noticeable or not.

Unselfishness.—In taking up nursing as a profession, women should fully realize that it is one in which duty must receive their first consideration. They must be ready to give of their best to others and to help one another. In the hospital there are limitations to the amount of help students are allowed to give each other; because there are those who, consciously or unconsciously, fail to make the effort necessary to accomplish their work if they feel that help is always at hand. When help is permissible it should be given willingly. Unselfishness, however, like other virtues, can be carried to extremes, and thus defeat its purpose; for example, nurses who disregard themselves to the point of impairing their health. On the contrary, they should endeavor to combine a faithful performance of duty with a judicious care of themselves, in other words they should be actuated by a true spirit of philanthropy, tempered by common-sense.

Professional Etiquette and Ethics

The object of this chapter being to draw the attention of students to qualifications which will not only cause others to trust and rely on them, but will remove many obstacles from their own paths, it seems well to include a few words regarding professional etiquette and ethics.

Professional Etiquette.—The etiquette of the army is, to a certain extent, repeated in the hospital. The reasons for its existence need not be discussed here; those who appreciate order and lack of friction will soon discover many for themselves. Nurses are required to stand when speaking to those in au-

thority, and to give precedence at all times not only to their superior officiers, *i. e.*, the superintendents, doctors, head nurses, but also to their seniors in the school. The members of the senior class should not be on familiar terms with their juniors, as they may be placed in positions of authority, and they will not obtain unquestioning, prompt obedience from those with whom they are too familiar.

Professional Ethics.—In this instance, professional ethics may be defined as the moral obligations which nurses owe to their school, its officers, doctors, their patients, and each other.

Obligations to the School.—A nurse's obligations to her school are twofold, viz.: (1) to so conduct herself in action and speech that she will do her part in gaining for it a good reputation; (2) to report conduct in any of her fellow-students which is likely to bring discredit upon the school.

Obligations to Officers.—By officers is meant all those in authority, but especially the superintendents, doctors, and head nurses. The two great obligations due to them are obedience and restraint from criticism. Obedience has been previously discussed. The second obligation is, unfortunately, daily and hourly forgotten. Every nurse in the school can see what she considers faults in the management of the hospital; the majority are ready to take offense at the slightest cause and to discuss their real or fancied injury with their class friends. Criticism of those in authority is harmful, because it generates a feeling of discontent in the school. Those who have a high sense of honor and loyalty will therefore not indulge in it. The officers of a hospital are not infallible, they frequently make mistakes,

they are sometimes unintentionally unjust; but school nurses should remember that they are not sufficiently experienced to pass judgment upon the officers' motives and actions. There is probably not a graduate nurse of any intelligence who, on looking back after experience has broadened her views, has not felt both mortified and amused at some of the egotistical judgments of her days in training.

Obligations to Patients.—Many of the obligations that a nurse owes her patients have been already discussed under the head of qualifications. There is, however, a point of honor on which too great stress cannot be laid; and that is the importance of keeping inviolable the secrets of patients and their families. When people are ill and in trouble they are apt to talk of things which in their calmer moments they would not mention, and it is exceedingly dishonorable to repeat anything learned under such conditions. In fact, the safest and most honorable course is never to discuss patients in any way. Many a nurse has had cause bitterly to regret a few careless words dropped about a patient under her care, or being unwittingly drawn into a discussion of former patients and their ailments.

If nurses would follow more closely the principles of the pledge which in many hospitals they are required to take at graduation, they would be less likely to commit the indiscretions for which they are often justly blamed. That all may become familiar with the precepts of the pledge, it is given below.

The Florence Nightingale Pledge.—"I solemnly pledge myself before God and in the presence of this assembly to pass my life in purity and to practice my profession faithfully. I will abstain from

whatever is deleterious and mischievous, and will not take or knowingly administer any harmful drug. I will do all in my power to elevate the standard of my profession and will hold in confidence all personal matters committed to my keeping, and all family affairs coming to my knowledge in the practice of my calling. With loyalty will I endeavor to aid the physician in his work and devote myself to the welfare of those committed to my care."

CHAPTER II

BACTERIOLOGY

Important Facts in the History of Bacteriology. The Nature, Characteristics, Methods of Reproduction, and Action of Bacteria, Yeasts, Molds, and Protozoa. Where these Organisms are Found. Nature of Ptomaines and Toxins. Conditions which Favor the Development of Microörganisms, Conditions which Retard their Development. Food Preservatives. Nature and Germicidal Power of the Disinfectants in More Common Use. Methods of Preparing Solutions and Calculating the Amount of Drug to Use. Laboratory Methods. The Collection of Specimens for Examination.

ALL measures for the prevention of infectious diseases are based on bacteriology. Hence, the study of this subject should be taken up early by persons who are being prepared to care for the sick. Indeed there is no other way by which they can gain such a knowledge of the existence of microscopical organisms as will cause them to realize that laws of asepsis and prophylaxis must be obeyed.

Important Facts in the History of Bacteriology

The minute organisms now known as bacteria (or germs) were first seen and described by Antony van Leeuwenhock in the year 1675, but neither Leeuwenhock nor several generations of his successors, owing to the inefficiency of their microscopes, were able

to gain sufficient knowledge of these "animalcules,"[1] as they then called these organisms, to be of any practical benefit.

In 1749, Needham and Liebig, Dutch chemists, declared that germs developed spontaneously, as the result of chemical change.

In 1762, Marcus Antonius Plenciz, a physician of Vienna, claimed a special germ for each disease and taught the probability of the multiplication of germs within the body and their transmissibility through the air.

In 1769, Spallanzani refuted Needham's teachings, showing that if infusions of decomposable vegetable matter were put into air-tight flasks, and these flasks were allowed to remain for some time in a vessel of boiling water, putrefaction was arrested.

In 1861, Louis Pasteur, of France, proved beyond doubt that germs come into existence by reproduction, and not by spontaneous generation. He also established the validity of Plenciz's theory regarding the cause and transmission of disease, and suggested that all putrefaction, the souring of milk, the fermentation of sugar, and like processes were due, and due solely, to the work of germs.

In 1869, Hoffman commenced the classification of these organisms. It is only since his day that the term "bacteria" has been used.

Pasteur and Hoffman were much handicapped in their work by lack of proper culture media in which to develop and study the germs. It was Robert Koch, who, in 1881, overcame this obstacle. He

[1] Their power of motility led Leeuwenhoek and many of his successors to believe that bacteria belonged to the animal kingdom.

noticed that separate colonies or groups of bacteria appeared on the surface of potatoes or bread which had been exposed to the air for some time, and that the different colonies never became confluent. He also noticed that a scum appeared on the top of bouillon under the same conditions. Wishing to see if separate colonies would form in the bouillon if it were solid, he added liquefied gelatine to it. Several modifications have since been made in the culture media of Koch, but the bases remain the same to this day.[1]

Lord Lister, in 1876, was the first surgeon to put Pasteur's and Hoffman's discoveries to a practical use. He soaked his instruments and dressings in carbolic, 1:40, and kept a carbolic spray, 1:20, playing constantly near the operating table while he worked. Later researches have shown that the carbolic spray was a mistake, it being impossible to disinfect the air in such a manner, and that carbolic is an inefficient disinfectant for dressings and instruments. But Lister's attempts at asepsis, imperfect as they were, met with such good results that a decided impetus was given to bacteriological researches.

The Nature and Classification of Bacteria

Bacteria, spoken of also as microörganisms, microbes, and germs, are the smallest and simplest forms of life known. They are, for convenience, classified with the group of colorless plants known as *fungi*, but their characteristics are not any more entirely those of plant life than of animal life.

[1] Media are preparations in which germs will thrive, and a culture is the propagation of bacteria in, or on, such media.

Nature of Bacteria.—A bacterium is an exceedingly minute, transparent, colorless, unicellular organism, consisting of cytoplasm,[1] that is surrounded by a wall and has, in or near the center, a small body called the nucleus[1] which controls the metabolism of the cell. Some bacteria have fine thread-like projections, known as *flagella*, extending from their wall, and such organisms have the power of independent movement, the flagella propelling the bacterium by a lashing motion.

Composition.—Chemically, the protoplasm composing the bacterial body consists of 80 per cent. to 90 per cent. water and varying proportions of protein,[2] fatty matter, carbohydrates,[2] and inorganic[2] salts.

Spores.—Some forms of bacteria when examined under the microscope are seen to contain a small, round, highly light-refractive body. This is known as a spore. Bacteria that are capable of spore formation are much more difficult to destroy than others, because a spore is infinitely more resistant to unfavorable conditions than the rest of the cell, and when conditions occur that cause the destruction of spore-bearing bacteria the spores may survive and, when favorable conditions are once more resumed, develop into the same kind of organisms as those from which they come.

Method of Reproduction.—Bacteria multiply by fission or division, *i. e.*, they increase in size and then divide into two equal parts. Under favorable circumstances, cell division takes place very rapidly, about every twenty minutes, and it has been estimated

[1] For explanation of these terms see Glossary.

[2] For explanation of these terms see Chapter XXVI.

that if cell multiplication went on unchecked for twenty-four hours, one bacterium would in that time have 140,750,000,000 descendants. It is, however, impossible for bacteria to increase with quite such rapidity because their surroundings after a while become unfavorable owing to the presence of acids and other poisonous substances produced by the bacteria, either as the result of the disintegration of the substances upon which they feed, or of the waste products given off from their bodies.

Conditions which Favor the Growth of Bacteria.—These vary somewhat with different species of bacteria, but all kinds of bacteria need food, warmth, moisture, and an absence of sunlight. Thus it can be seen that warm, dark, moist places are propitious for the development of bacteria. The reaction of the medium upon which they are growing is of importance to most bacteria; nearly all varieties grow best in a neutral medium or one that is but slightly acid or slightly alkaline. Some bacteria require oxygen—air—others thrive better in places where there is little air, and others live equally well with or without air. The temperature in which bacteria grow best varies for different species, but for the majority of varieties a temperature between 75° to 100° F. is the most favorable.

Food.—The majority of bacteria, unlike the higher species of plants, require organic food, either vegetable or animal, for their sustenance. One reason for this is that they do not contain chlorophyll, the green coloring matter of plants, by virtue of which plants, under the influence of the sunlight, are enabled to use the carbon dioxide (CO_2) and water (H_2O) for their nourishment and to put the elements carbon, oxygen,

and hydrogen and various others as nitrogen, sulphur, iron, which they get from the soil, together, and so form the substances starch, cellulose, etc., of which they are composed. Most bacteria, therefore, having no chlorophyll, are, like animals, directly or indirectly dependent upon the higher plants for their nutrition. Some forms of bacteria feed upon dead organic matter, but others require living substance.

Method of Obtaining Food.—The wall of the bacterial cell, like that of the cells of other plants and of animal cells, permits of the passage of fluids containing foodstuffs, and they obtain their food by a process of absorption.

Changes Made in Food.—Just as the cells of animals require that the changes we call digestion be made in food before they can assimilate it, so does the bacterial cell, and the changes wrought by bacteria in such substances as proteids and carbohydrates are, in some cases, very similar to those occurring in the human alimentary canal as the result of digestion; in fact, certain bacteria that are always present in the intestines of animals aid in digesting food.

Ptomaines.—The changes wrought by certain species of microörganisms, known as *putrefactive bacteria*, in the protein substances existing in eggs, cheese, meat, and the like, sometimes give rise to substances that have been named *ptomaines*. These were thought to be poisonous, and the poisoning that has followed the eating of decomposed meat, etc., has been attributed to these ptomaines; but many authorities now consider that such poisoning is due, not to ptomaines already formed in food, but to the action of the bacteria taken into the body with the infected food.

Enzymes.—The reason that bacteria can cause

such changes in the matter on which they feed is that they, like many cells in the animal body, are capable of producing substances known as *ferments* or *enzymes*, many of which are comparable to the enzymes found in the digestive juices of the alimentary canal and to those in the body tissue which cause oxidation and the other metabolic changes described in Chapter XXVI.

TOXINS.—In the bacterial body, as in that of all animals and plants, metabolic processes are continually going on, and these processes, in some bacteria, give rise to substances that are highly poisonous to the animal body. These substances have been named toxins. Of their exact nature but little is as yet known, but it is certain that the toxin produced by each species of bacteria is different from that produced by all others. The toxins produced by the majority of bacteria are excreted into the media in which the microörganisms are growing, but that produced by a few species of bacteria, notably the cholera spirillum and the typhoid bacillus, is not excreted into the media, but is attached more or less firmly to the bacterial body. Such toxins are termed *endotoxins*.

The comparative degree of toxicity of this kind of toxin and other well-known poisons can be seen in the following table: [1]

"Minimal fatal dose of			atropin for an adult man	130 mg.
"	"	"	strychnin for an adult man	30 to 40 mg.
"	"	"	cobra venom for an adult man	4.375 mg.
"	"	"	tetanus toxin for an adult man	0.23 mg."

ACTION OF BACTERIA.—There are a great many species of bacteria and different species give rise to

[1] Edwin O. Jordan, Ph.D.: *General Bacteriology*, page 101. W. B. Saunders Company.

different results in the medium in which they are active. Some of the more common results of their activities are putrefaction, fermentation, and other forms of disintegration such as are continually taking place in inorganic substances, for instance, denitrification[1] (see following paragraph) and the formation of certain inorganic compounds as in nitrification[2]; the production of diseases both in plants and animals, and the production of inflammatory conditions in animal tissues.

Uses of Beneficent Bacteria.—The results of the activity of bacteria described in the preceding paragraph are not all injurious to the life of either plants or animals, in fact the majority of them are absolutely essential. For instance. the life of plants, and thus of animals, is dependent upon the action of the putrefactive and nitrifying bacteria, for the reason that plants need nitrogen for their growth and this they cannot get from the air as they do carbon and oxygen; they are thus very dependent upon that present in the soil in the form of nitrites and nitrates, and these nitrogen compounds are derived by the action of *nitrifying bacteria* upon ammonia, urea, etc., substances produced by the action of other species of bacteria, which cause the putrefaction of dead animal and vegetable matter.

The soil is also supplied with *nitrogen fixation bacteria*. These enter the roots of certain plants known as the *legumes* (peas, beans, clover, etc.) and as these microorganisms have the power of assimilating large quantities of nitrogen from the air, the nodules or tubercles which form on the roots of such plants, in consequence

[1] The setting free of nitrogen.

[2] The conversion of the nitrogen of decomposed proteid substances into nitrogen compounds such as nitrates.

of the invasion of the germs, become filled with nitrogen compounds. When the crops are harvested these roots are left in the soil, where they become disintegrated, and the soil thus obtains more nitrogen with which to supply the plants put into it. Bacteria are useful to plant growth also in other ways too numerous to mention here, and they are essential to many industries in which decomposition of organic matter is required, for instance, the curing of tobacco, the retting of flax, the tanning of hides, etc., and it is to bacteria that the characteristic flavors of butter and some cheeses are due. Many of the varieties of bacteria used in such industries are now cultivated in laboratories and thus *pure cultures* of the desired microörganisms can be had. This is of great benefit, because when it was necessary to obtain bacteria by exposing substances to the air, ones harmful to the material often gained entrance in larger numbers than the desired species, and the substance was thus ruined. Another important function of bacteria is the part which those always present in the alimentary canal take in digestion. This will be discussed in Chapter XXVI.

Action of Disease-Producing Bacteria.—The morbid conditions produced in the animal body as the result of infection by pathogenic (disease-producing) bacteria is usually due to the poisonous products which they produce as the result of their metabolism; these substances, as has already been stated, are called *toxins*, and the toxin produced by each species of bacteria is different from that produced by others and causes different symptoms in the body. Conditions caused by certain bacteria are those of inflammation and suppuration (see page 213). The various species

of germs which induce these conditions are classed as *pyogenic* (*pus-producing*) *bacteria.*

HOW PATHOGENIC BACTERIA GAIN ENTRANCE TO THE BODY.—The ports of entrance for bacteria into the human body are the alimentary canal, the respiratory passages, the genito-urinary system, and broken surfaces in the skin or mucous membrane. This matter will be further considered in Chapter XXVI.

WHERE BACTERIA ARE FOUND.—Bacteria are almost omnipresent where organic life exists—they are found in the air, except at very high altitudes, and on the surface of substances exposed to the air, except such as will destroy them, *e. g.*, exceedingly hot material; they are found in the soil to a depth of ten or fifteen feet, and are especially numerous in moist or freshly fertilized soil; they are found in all surface water and even to some extent in the ocean. Contrary to general opinion, the water of lakes and ponds does not usually contain as many bacteria as the running brook. The supply streams of a lake or reservoir always contain more bacteria than the lake or reservoir; this is because the rains wash the dust and surface débris of the soil into the brooks, and, in many cases, sewage enters the brooks, and in the waters of the lakes and reservoirs, which are constantly exposed to the sun, and where there is a lack of dead organic matter, many bacteria soon die or settle to the bottom. Water of artesian wells and spring water will contain very few bacteria, if care is taken to prevent their contamination at the surface. The freedom of the country well from bacteria depends upon its location; the well near a privy vault is likely to be highly contaminated because the contents of the vault sink into the ground and the fluid constituents and bac-

teria are distributed in all directions. Rain water and snow usually contain a large number of bacteria, which they gather with the dust as they pass through the air. Numerous bacteria will always be found on the surface of the human body and they exist in large numbers under the nails, in the mouth, nasal passages, upper respiratory tract, the conjunctiva, the intestines, and the external ducts of the genito-urinary system. Normally, bacteria are not present in the deeper tissues nor in the internal organs other than those mentioned. All forms of bacteria are not equally omnipresent, *e. g.*, the majority of pathogenic bacteria (those which produce disease) are not as prevalent as many of the non-pathogenic varieties, and many of the pathogenic varieties are much more widely distributed than others. The tubercle bacillus—the microbe which causes tuberculosis—for instance, is much more common than the typhoid bacillus, and the latter than the organisms producing scarlet-fever[1] and smallpox.[1] Bacteria which cause suppuration in wounds are especially prevalent and they, like all other pathogenic bacteria, are present in greater numbers where there are individuals already infected by them, as for example in hospitals.

How Infection is Spread.—In disease due to bacterial invasion, in which the principal seat of the disease is at all localized, the bacteria are given off from the body of an infected individual principally in the excreta or discharge from the part of the body in which the lesions or seat of the disease are located. For instance, the germs causing diphtheria are given

[1] No specific organisms have as yet been found for these diseases, but the nature of their transmission is thought to be sufficient proof that they are caused by bacteria.

off in the discharge and membrane of the lesions in the throat; those causing typhoid are given off principally in the feces, though to some extent in the other excreta; bacteria causing inflammation of the tissues are contained in the pus discharged from the wounds. In diseases such as smallpox, measles, scarlet-fever, the organisms causing which have not as yet been isolated, the infection carrier is thought to be given off principally in the discharges from the throat and nose and in the discharge from the pustules that cover the body in smallpox, and perhaps in the scales of skin that peel from the body in scarlet-fever and measles. Small particles of infectious discharge may contain many millions of bacteria, and an object soiled with such matter may, unless preventive measures are taken, infect anything or anyone touching it, and these in turn can then transmit infection. The hands of those caring for people afflicted with diseases due to bacterial infection are particularly likely to become contaminated. Also, such discharge may become dried and its bacterial contents scattered, and, though bacteria in a dried condition are inactive, as soon as they find lodgment on suitable surroundings they will, unless they have been dry for some time, once more begin to multiply and regain their virulence. Thus, they may fall on food and infect it; they may fall on surgical instruments or dressings and so be put into a wound. Flies may be a source of infection unless care is observed to at once destroy or cover infectious matter, for they may alight upon such material and later upon food, etc. Mosquitoes also are the carriers of certain diseases. This, and other means of transmitting infection, will be further discussed in Chapter XXV.

Classification.—Bacteria are variously classified, *e. g.:*

(1) According to the nature of the food they require bacteria are known as

(*a*) Saprophytes[1]—these live on dead organic matter, and it is to various species of this class of bacteria that decomposition, putrefaction, and fermentation are due.

(*b*) Parasites[2]—these depend upon living animal or vegetable matter for their nutriment.

(*c*) Autotrophic[3]—these, like green plants, can exist on carbon dioxide, other gaseous elements, and inorganic salts.

(2) With regard to their oxygen (air) requirements, bacteria are known as:

(*a*) Aërobic—those which require air for their subsistence.

(*b*) Anaërobic—those which thrive best without air.

(*c*) Facultative aërobic or anaërobic—those which can live equally well with or without air.

(3) Depending upon the nature of the chemical changes which bacteria cause in the substances they use for food, they are known as:

(*a*) Putrefactive—those which produce putrefaction.

(*b*) Zymogenic—those causing fermentation.

(*c*) Aërogenic—those that give rise to gas.

(*d*) Chromogenic—those which produce color. These bacteria, in the course of their growth,

[1] From a Greek word signifying putrid.

[2] From a Greek word used for any animal or plant subsisting at the expense of another organism.

[3] From two Greek words meaning self-nourished.

give rise to various colored substances. Common examples are the *bacilli prodigiosus*, which causes a brilliant red color,—it is found chiefly on putrid foodstuffs,—and the *staphylococcus pyogenes aureus*, one of the pus-producing bacteria; this gives rise to a yellow hue.

(*e*) Photogenic—these bacteria produce phosphorescence. They are found principally in and around sea-water and the phosphorescence that is sometimes seen on decaying fish is often due to this class of micro-organism.

(4) Another classification is:

(*a*) Non-pathogenic, those which do not produce disease.

(*b*) Pathogenic, those which do produce disease.

(*c*) Pyogenic, those which cause suppuration.

(5) With reference to their shape, bacteria are classed as:

(*a*) Cocci, singular coccus, round.

(*b*) Bacilli, singular bacillus, rod-shaped.

(*c*) Spirilli, singular spirillum, spiral-shaped.

Cocci.—The cocci are round or somewhat oval-shaped microbes about $\frac{1}{25,000}$ of an inch in diameter. According to their method of divisioning and grouping in culture media, they are known as:

(*a*) Streptococci—which divide in one plane and, when they remain connected after division, occur in chains.

(*b*) Staphylococci—these divide in two planes and, when they remain connected after fission, they form grape-like clusters.

(*c*) Diplococci—these occur in groups of two.

(*d*) Sarcinæ—which divide in three planes and, when they remain together after fission, form cube-like bundles.

The cocci, as well as other forms of bacteria, are also classified with regard to their power of movement and other characteristics, but as the names of such classification are not frequently referred to they will not be given here.

Bacilli.—The bacilli are all, as their name signifies, rod-shaped, but there are several variations in their form; thus, certain species of bacilli have rounded ends, others are square or club-shaped, others are of an almost oval shape, etc. Bacilli also vary considerably in size, but average about $\frac{1}{60,000}$ of an inch in length.

Spirilli.—These are spiral-shaped microörganisms. Some species have but one curve and are comma-shaped, others have two or more curves and are likened to a cork-screw.

Fungi Organisms Similar to Bacteria.—Two classes of fungi comparable to bacteria are the yeasts and the molds.

Yeasts

Names of Yeasts.—Yeast cells are known as blastomycetes—budding fungi—because they multiply by budding; *i. e.*, a small projection or bud forms on the parent cell, which enlarges, breaks off, and forms a new separate cell. Yeasts are also called saccharomycetes—sugar fungi—because of their ability to produce alcoholic fermentation in sugar.

Nature of Yeast Cell.—A yeast cell consists of a simple oval or spherical mass of protoplasm contain-

ing a number of spores and encased in a cellulose wall.

Action of Yeast.—Yeast produces two different ferments or enzymes, one of which converts starchy substances and cane sugar into a simple sugar called *glucose*, and the other causes fermentation of this sugar with the consequent formation of alcohol, or if the process is carried further, carbon dioxide and water.

Examples of fermentation due to yeast are: The alcoholic fermentation that lactose—sugar of milk—is made to undergo in the manufacture of kumyss; the fermentation of the sugar of grapes, which changes the sugar into alcohol; the change of the starch of potatoes, rye, etc., into sugar and the sugar into alcohol; the changing of the flour of dough into sugar and the sugar into carbon dioxide gas, which, when heated, expands and makes the dough rise.

Conditions which Favor the Development of Yeast.—Yeast grows satisfactorily only when (1) in a watery medium containing a fermentable sugar; (2) in the presence of a suitable proportion of nitrogenous and mineral matter, such as phosphates, potash, lime, etc., these being required for the growth of the yeast; (3) at a suitable temperature, best at about blood heat; and (4) as long as the alcohol produced by its action does not exceed about 15 per cent.

Where Yeasts are Found.—Yeasts, like bacteria, are very prevalent in the air and on surfaces exposed to the air.

Use of Yeast in Ancient Times.—In the most primitive state of civilization, cereals of various kinds were crushed by means of stones or crude mills. The

flour so made was mixed with water and allowed to stand exposed to the air for hours and then baked, and frequently part of the unbaked dough was saved to add to that which would be made at a future date. This method of making bread was used because it had been discovered that dough which was allowed to stand for some time before baking was more porous and palatable than that baked immediately upon mixing, and that kneading a portion of dough, saved from that made on a previous day, into a fresh mixture caused still further improvement. This change in the dough, was of course, wrought by yeast from the air, and the reason that the saved dough improved the bread was that the yeast cells in it had had time to develop and were more active than those existing in a more or less dried condition in the air.

Nature of Compressed Yeast.—Bread made in the manner just described was often ruined by bacteria or molds getting into the dough in larger numbers than the yeast, and, therefore, as soon as methods of securing pure cultures of yeasts and bacteria were discovered attempts were made to obtain yeast cultures for bread-making. Of this nature is the compressed yeast so much in use at the present day. It is made about as follows: A culture of pure yeasts are grown in a suitable media until they are properly developed, when the cells are filtered out of the liquid in which they were grown by fine sieves, usually of bolting cloth, and are washed with cold water and pressed. The resulting mass is mixed with 25 to 50 per cent. of starch and flour. If kept at a low temperature, compressed yeast will keep for a long time and the vitality of the yeast cells will return when they are put into fermentable solutions. Com-

pressed yeast, however, rapidly decomposes in warm, moist air.

Molds

Nature of Molds.—The molds, of which there are several varieties, belong to a higher class of fungi than bacteria; they are nearly allied to the algæ[1] and similar fungi. The molds are characterized by the development of long slender threads, some of which project like delicate roots into the substance of the material upon which the fungi find lodgment, even when the material is of such hard substance as wood. These fungi take their nourishment from the substance upon which they lodge and in so doing cause chemical changes that result in the disintegration of the material.

Reproduction of Molds.—Molds multiply by a process similar to seeding. The seeds are called *spores*. These spores are usually even more abundant in the air than bacteria and when they fall upon favorable ground they develop into molds similar to that from which they sprang.

Varieties of Molds.—There are, as previously stated, a great variety of molds, some of which are seen principally on foodstuffs, *e. g.*, the molds that form on bread, preserves, fruit, etc. Other varieties sometimes attack growing grain and other plants, and a few species cause pathogenic conditions in man; the more common of these are the skin diseases known as *ringworm* and *favus*. There is also a disease of the mucous membrane of the mouth, known as *thrush*, which is due to a microörganism, known as the

[1] Latin *alga*—seaweed (plural *algæ*).

oïdium albicans, that resembles both yeasts and molds.

Conditions which Favor the Development of Molds.—The conditions that favor the development of the molds are the same as those which favor that of bacteria. The more important of these, as previously stated, are (1) the presence of material upon which they can feed, (2) moisture, (3) warmth, (4) an absence of sunlight.

Protozoa

Nature.—Protozoa—singular, protozoön—are single-cell animals. They vary in size, the smallest ones being the size of the smallest bacteria and the largest about one quarter of an inch in length.

Manner of Movement.—Some protozoa have minute, delicate, hair-like projections, called *cilia*, extending from their wall, which propel the organism with a soft wave-like motion. Others have fewer, but coarser, projections called *flagella*, to which they owe their power of motion, and still others move by what is often designated *ameboid movement*, because it is the movement characteristic of a very common species of protozoa known as the *ameba*. The ameba moves about and also absorbs nourishment by constantly changing its shape and extending out from its circumference processes of protoplasm called *pseudo podia*.

Fig. 1. Ameboid Movements

Pathogenic Protozoa.—Different species of protozoa are the cause of several serious kinds of cattle

plagues, and, especially in the tropics, there are several other species that cause diseases in man; of these the most common are: *malaria*, *amebic dysentery*, and the *sleeping sickness*, a disease common in certain parts of Africa. The specific microörganism causing hydrophobia, it is thought, is of this type, but this is still uncertain.

Transmissions of Protozoa.—The protozoa which give rise to amebic dysentery are usually taken into the body in infected drinking water, the protozoa of malaria are injected into the blood by a certain form of mosquito—this will be further discussed in Chapter XXV. The sleeping sickness is transmitted by the bite of a fly, known as the *tsetse fly*, and the organism that causes hydrophobia is transmitted by the bite of animals suffering with the disease.

Methods of Preventing the Growth of and of Destroying Bacteria, Yeasts, Molds, and Protozoa

Meaning of Terms Used in Connection with the Above Methods.—There are certain terms used in connection with the methods of preventing the growth of and of destroying bacteria, the meaning of which it is necessary to understand. These are:

Antisepsis—Against putrefaction. The exclusion of germs.

Antiseptics—Chemical substances that check the development of germs, but do not destroy them.

Asepsis—Freedom from infection.

Disinfectant—Anything that will kill germs.

Infection—The communication of disease organisms.

Sepsis—Poisoning as the result of germ infection.

Sterilization—The process of freeing from germs. The word is commonly used in connection with the destruction of organisms by means of heat.

METHODS OF PREVENTING THE GROWTH OF BACTERIA, MOLDS, ETC.—As stated several times in the preceding pages, certain conditions are necessary for the development of bacteria and other microörganisms; naturally, the opposite of the conditions favorable for their development will be ones that will best prevent development, and such conditions are secured by cleanliness and sunshine and in some cases by the use of antiseptics or disinfection.

THE PRESERVATION OF FOOD FROM THE ACTION OF BACTERIA.—The prevention of the development of microörganisms is a very important consideration in the preservation of food, and the usual means taken to do so in this connection are the use of cold and antiseptics and drying the food material.

Cold as an Antiseptic.—Cold, *i. e.*, below 40° F., will hinder the development of germs, but it cannot be relied upon for their destruction, since bacteria frozen in ice will remain alive many weeks.

Drying.—Lack of moisture inhibits the activity of germs and long-continued drying will destroy many species. Dried foodstuffs do not offer a favorable medium for the development of bacteria or other organisms and for this reason dried cereals, vegetables, and fruits will not readily decompose if kept in a cold, clean, dry place. Meat and some fruits, contain so much water that it is hard to preserve them by drying alone, and the use of salt, sugar, or other preservatives is usually resorted to in addition to drying.

Antiseptics — Preservatives. — There are quite a number of chemical substances, the names of which

will be given later (page 62), that prevent the activity and multiplication of germs. They are called antiseptics. Of these, a few are harmless to man and can therefore be used to prevent germ invasion of food. Such substances are called *preservatives*. The ones most commonly used are salt, sugar, and vinegar—acetic acid. Other antiseptics, such as boracic acid, borax, formalin, salicylic acid, are sometimes used, but as ingestion of such substances may be attended with more or less danger to health, their use is forbidden by law. Some of the stronger objections to the use of drugs as preservatives are:

(1) Either intentionally or by mistake a larger amount of the drug than is usual may be used.

(2) Nearly all antiseptics interfere with digestion, and though, in the small amounts in which they are usually used with food, this action might not be sufficient to affect healthy adults it is very likely to do so with small children and invalids.

(3) If the use of antiseptics is allowed, it is not as necessary to select good food nor to keep it clean and free from germs. This is particularly true of milk.

Sugar as a Preservative.—In using sugar for the preservation of food, it must be remembered that sugar is a preservative only when in crystalline form or in a concentrated solution. A weak, watery solution undergoes fermentation very readily under the influence of either such forms of bacteria as cause this process or yeast. Sugar is very widely used for the preservation of fruit.

METHODS OF DESTROYING BACTERIA.—The destruction of bacteria may be said to be effected by (1) physical agents and (2) chemical agents.

Physical Agents

The physical agents are light and heat.

Sunlight.—Bacteria exposed to direct sunlight are killed in a few hours and even bright daylight interferes with their activity, and the brighter the light, the more effectual its action. It is, however, almost impossible to depend upon the sunlight as a disinfectant, since actually to destroy bacteria it must shine directly upon them for the required length of time, but sunlight is an important factor in the prevention of their development.

Electric Light and Röntgen Rays.—Electric light has the same effect upon germs as sunlight, though to a less extent, but the Röntgen rays have not as yet been found satisfactory germicides.

Sterilization by Heat

Methods of Using Heat.—The four methods of disinfection or, as it is usually called, *sterilization* by heat are:

1. Boiling.
2. Streaming steam.
3. Steam under pressure.
4. Hot air.

Difference between Streaming Steam and Steam under Pressure

Nature of Streaming Steam.—By streaming steam is meant the steam that arises from water when it is boiling, the escape of which is not prevented. The temperature of streaming steam is the same as that of boiling water, viz., 212° F. or 100° C.

Nature of Steam under Pressure.—Steam, under pressure, is, for the purpose of sterilizing, generally secured by allowing it to pass into a strong metal steam-chamber, which can be made air-tight. The steam which enters is not allowed to escape and the molecules of which it is composed, being in perpetual motion, strike against each other and the walls of the containing chamber. This bombarding of the chamber-walls by the steam in its efforts to escape is known as pressure, and the amount of pressure exerted is expressed in pounds, meaning so many pounds to the square inch. The enormous force that steam under pressure can exert will be understood when it is realized that if the amount of pressure is allowed to exceed that which the sterilizer is guaranteed to stand the doors may be forced open, in spite of heavy bolts, or the apparatus otherwise injured.

Temperature of Steam under Pressure.—Pressure, like all other forms of force, produces heat and the increase in the degree of temperature will be in proportion to the increase in the amount of pressure. Thus, at a pressure of fifteen pounds to the square inch, steam has a temperature of approximately 248° F., or 120° C., and at a pressure of twenty pounds, it has a temperature of 276° F., or 125° C.

Value of Heat as a Disinfectant.—A high degree of heat will destroy all living things. It is therefore an effectual disinfectant. The degree of heat necessary to use will depend upon (1) the species of organisms to be destroyed, (2) the manner in which the heat is obtained, (3) the purpose for which the material being sterilized is to be used, (4) the nature of the material being used.

Difference in the Thermal Death-Point for

Different Bacteria.—The amount of heat necessary to kill bacteria differs somewhat with the species. To exterminate spore-bearing bacteria, a much greater amount of heat is necessary than for the non-sporulating species, since the spores will survive exposure to a much greater amount of heat than any kind of bacteria. Ten minutes' exposure to a temperature of 158° F., 70° C., moist heat, will destroy the germs causing cholera, diphtheria, erysipelas, pneumonia, typhoid fever, tuberculosis, and practically all the diseases due to non-spore-bearing bacteria, and boiling will kill them at once. The bacilli of tuberculosis is somewhat more difficult to destroy than the others mentioned here for it requires 70° C. and nearly all the others will all be killed at or below 60° C. The spores of sporulating germs—such as tetanus—require fifteen minutes' exposure to a temperature 120° C., 248° F., moist heat; this can, of course, only be obtained with steam under pressure. These temperatures and lengths of time for exposure are only sufficient when the germs are brought directly under the influence of the heat; if the material being sterilized is at all dense or rolled in bundles, the temperature and time of exposure must be increased.

Comparative Efficiency of Moist and Dry Heat.—Hot moisture is very much more penetrating than hot air. Bacterial spores that will resist the influence of dry heat at a temperature of 280° F. for hours will, with moist heat, be destroyed at a temperature of 235° F. in thirty minutes. To be efficiently sterilized with dry heat articles must be exposed for one hour to a temperature of 300° to 324° F. and very few materials will stand this degree of heat without deteriorating. Dry heat is, therefore, now seldom

used for sterilizing purposes outside of the bacteriological laboratory.

Other Conditions that Affect the Time Required for Sterilizing.—(1) The purpose for which the substance being sterilized is to be used; *e. g.*, sterilization of anything intended for use in or around wounds must be more thorough than that for the destruction of germs which enter the body through the alimentary canal. Thus, water intended for drinking purposes will be usually sufficiently sterilized by boiling for one minute; that intended for surgical purposes must be boiled for twenty minutes. There are two reasons for this. (*a*) None of the bacteria which gain entrance to the body through the alimentary tract are, as far as is known, of the sporulating type and a few of those which cause morbid processes in wounds are. (*b*) Should some germs be rendered inert, but escape absolute destruction, they will, if put into a wound, be given every possible condition necessary for their recovery; on the other hand, if introduced into the alimentary canal, the acid gastric juice in the stomach and the alkaline fluids in the intestine will prevent their recovery.

(2) The nature of the material being sterilized is a very important consideration in determining the degree of sterilization necessary; smooth, polished, non-absorbent objects, such as scalpels, glass basins, and the like, are very easily rendered sterile, especially if they are well rubbed when cleansed. Grooves and rough surfaces interfere with sterilization. Absorbent material is more difficult to render sterile than non-absorbent, and the thicker it is, the greater the difficulty, and substances that afford nutritive material for bacteria are harder to disinfect thor-

oughly than those on which bacteria become dried and inert.

Important Points to be Considered in Sterilizing.—The method of sterilizing instruments, surgical dressings, etc., will be described in Chapters XXI and XXIII, in connection with the care of wounds and of operating-room technique, and the disinfection required in the care of patients suffering with infectious diseases will be described in Chapter XXV. There are, however, a few points extremely important to remember in all sterilization, which will be mentioned here. (1) After use, instruments, apparatus, etc., are sterilized before being cleaned, otherwise, if they contain infective material they will contaminate everything with which they come in contact. If, however, matter containing albumin is present—as pus or blood—it must be removed by immersing the objects in cold water, for the reason that the heat coagulates albumin and the coagulum thus formed will protect the germs from the influence of the heat. The water used for this purpose is to be emptied into the hopper or toilet, *never into a toilet basin*, and the utensil that contained the water must be sterilized. (2) Sterilization must be continued as long as necessary, but no longer. Over-sterilization is a waste of fuel and will ruin many kinds of material, rubber, for instance; and in the case of drinking water, boiling it longer than one minute causes a loss of gas, which makes the water unpalatable and consequently the people who have to drink it seldom take as much water as they should. (3) Glassware must be always heated and cooled slowly. Glass will break just as readily if it is cooled quickly, as if heated quickly. The reason for the breaking of glass by sudden heat-

ing and cooling is that heat causes glass to expand and cold makes it contract, and if the heat or cold is applied suddenly, some parts of the glass will contract or expand more quickly than others. (4) Sharp points, as those of needles or scalpels, should be protected during sterilization. (5) Carbonate of soda, sufficient to make a 1 per cent. solution, should be added to the water in which instruments are sterilized—the soda, in addition to being a germicide, prevents instruments becoming rusted and blunted. (6) The addition of salt to the water—about one dram to a quart of water —is said to prevent the softening of rubber. (7) Rubber material must not be boiled in soda solution, as this softens it.

Fractional Sterilization

When sterilizing articles by steam, not under pressure, it is sometimes necessary to expose them to its influence on three successive days, for from forty minutes to one hour each day. This process is known as fractional sterilization. The reason why it is necessary is that the maximum temperature of steam, not under pressure, 212° F. or 100° C., though sufficient to kill bacteria, is not adequate to destroy the spores which may be present. Consequently it takes several steamings, with intervals between, in which the spores may develop, to destroy them all. To favor the development of the spores keep the articles being sterilized in a temperature of about 80° F. between the successive steamings. If the articles are to be used for surgical purposes, wrap them, before beginning sterilization, in a thick covering and keep

them in a scrupulously clean receptacle between and after the steamings.

Chemical Substances Used for the Destruction or Inhibition of Germ and Insect Life

Classification.—Chemical substances which will kill bacteria are classed as *disinfectants* and *germicides*. The majority of disinfectants will kill insects and other low forms of animal life. Those that will are known as *insecticides*. Chemicals that inhibit the multiplication of germs and prevent them producing toxins—in other words, which render germs inactive, but do not destroy them—are called *antiseptics*. Substances that mask or destroy odors are known as *deodorants*. Some of these have disinfectant and antiseptic properties; others have not.

Physical State.—The three physical states of matter, solid, liquid, and gas, are represented in the chemicals used for the purposes described in the last paragraph. The solids are all of a soluble nature and are generally dissolved in water and used in the form of a solution. Some of the gases, also, are dissolved in water, and thus made into a solution.

Important Rules to Remember in the Use of Liquid Disinfectants.—(1) To be effectually disinfected by a germicidal solution, a substance must be thoroughly saturated and covered with the solution, so that the latter will come in direct contact with the contagious principle. (2) Nearly all disinfectants are more efficacious warm or hot than cold. The temperature of the water used to dilute the cresols should not exceed 100° F. (3) Material being disinfected by

solutions of which the active principle is a gas must be kept covered during disinfection.

Disinfectants

Some of the more important of the disinfectants in common use are:

Alcohol

Germicidal Power.—Alcohol between 60 and 70 per cent. will kill sporeless organisms within fifteen minutes. In higher per cents and between 40 and 60 per cent. alcohol has antiseptic but not disinfectant properties. The reason for the lack of disinfectant power of the higher per cents of alcohol is thought to be that alcohol fails to penetrate microbes unless in the presence of water, and, also, that it coagulates organic matter present, and thus forms a protective coat around the micro-organisms.

Bichlorid of Mercury (Corrosive Sublimate)

Time and Strength of Solution Necessary for Disinfection.—A solution of 1:2000 bichlorid will kill non-spore-bearing bacteria in an hour; a solution of 1:1000 will do so in half an hour, and a solution of 1:500 in half that time, but to kill spores, exposure for one hour to a solution of 1:500 is necessary. Solutions much weaker than 1:2000 are only antiseptic. The addition of alcohol to aqueous solutions of bichlorid of mercury enhances the germicidal power of the latter.

Substances for the Disinfection of which

Bichlorid cannot be Used.—Bichlorid must not be used for the disinfection of animal excreta because mercury combines with the albumin, sulphur, and alkalies present in such excreta and so forms insoluble, inert compounds, and the hard insoluble albuminate of mercury and other matter thus formed prevents the penetration of any uncombined bichlorid to the germs contained within the mass. Bichlorid must not be used for the disinfection of toilets, hoppers, etc., nor for instruments, nor other metal objects for it corrodes metal. Bichlorid stains white fabrics, wood, and light colored paints. Formerly, bichlorid of mercury was much used for the irrigation of wounds, and for vaginal douches, but since the discovery of its action on albuminous substances, its use for these purposes has been largely discontinued.

Uses of Bichlorid of Mercury and Care Necessary in its Use.—As can be readily inferred from the preceding paragraph, the use of bichlorid, though it is a very effectual germicide, is somewhat limited—in fact, it is almost confined to the disinfection of glass and enamel ware and the skin. Bichlorid is very widely used for the disinfection of the hands. There are two important points to remember, however, when using bichlorid for this purpose: (1) that the hands must be clean, for bichlorid will not penetrate through any fatty substance; (2) that all soap must be removed from the hands before immersing them in the disinfectant. The reason for this is that in order to render bichlorid more soluble and to prevent it combining with albumin to such an extent as it does naturally, a dilute acid or certain chlorids—such as ammonium or sodium chlorid—are added to the bichlorid powder and the alkaline substance of soap

will unite with this acid or precipitate the salt and the mercury then unites with the protein substances on the skin. This not only interferes with its disinfectant properties, but also renders it irritating to the skin.

Bichlorid solutions are odorless and, unless coloring matter is added, colorless; they must therefore never be left where they can be mistaken for water, for bichlorid of mercury is poisonous. White of egg is the chemical antidote.

Carbolic Acid or Phenol

Nature.—Carbolic acid, a coal-tar product, is a crystalline solid which softens when exposed to the air, and is soluble in 15 parts of water. It is not a true acid. It is a corrosive poison. Alcohol is the chemical antidote.

Germicidal Power.—Carbolic ½ per cent. is able to destroy certain sporeless bacteria in a few minutes, but, for practical purposes, it is considered that an exposure of one hour to a 5 per cent. solution is advisable, and this can be relied upon only for non-sporulating organisms. Exposure for two days to a 5 per cent. solution has been found necessary to kill some spores. Carbolic is most effectual when the temperature of the solution is about 98° to 100° F.

Uses of Carbolic.—In solutions of a strength usually used as a disinfectant, carbolic does not injure color nor destroy fabric, metal, or wood. It does not coagulate albumin, nor is it, like bichlorid, changed into a non-germicidal substance when it comes in contact with the matter of animal excreta. It can, therefore, be used for the disinfection of these

things. It is sometimes used in weak solutions about 1:120 for vaginal douches; also, on account of the depressing effect which it has upon the sensory nerve endings in the skin it is sometimes used as a *wet dressing* for relief of pain in cases of local infection, where there is no incision, or only a very small incision. When carbolic is used for the latter purpose the dressing must not be covered with an air-tight protector and the skin must be watched or blistering followed by gangrene may occur.

Care Necessary in Preparing Carbolic Solutions.—Carbolic is usually bought either in crystals or in a 95 per cent. solution. The latter is an excessively corrosive, oily liquid which does not mix easily with water. In making weaker solutions from the stronger the water is best added a little at a time and the bottle well shaken between additions. The bottle must be shaken until all oily globules disappear, for these will burn any tissue with which they come in contact. Care must be taken in the preparation of carbolic solutions not to let any of the crude carbolic drop on the hands. If this should happen, pour some alcohol over the part immediately; if alcohol cannot be procured at once, hold the injured part in soap and water until it can. Prompt action will prevent burning.

Copper Sulphate

Uses.—Copper sulphate is used in dilute solutions 1:1,000,000 for the destruction of the microscopic algæ that sometimes infest and give an unpleasant odor and taste to public water-supplies. Copper sulphate is sometimes used in 1 per cent. solutions for irrigation of ulcers and the solid crystals are used occa-

sionally to touch exuberant granulants, but this is for the caustic and astringent action of the drug rather than for its disinfectant property.

The Cresols

Names and Nature.—The best known of the cresols are tricresol, lysol, and creolin. These, like carbolic, are derived from coal tar. They are less poisonous than the latter.

Uses and Germicidal Power of Tricresol.—Tricresol can be used for the same purposes as carbolic. It is generally used in a 1 per cent. solution and is about three times as strong as carbolic. A 5 per cent. solution will, some authorities claim, kill spores in an hour.

Uses and Germicidal Power of Lysol.—Lysol consists of cresols and potash soaps; it has about the same germicidal action as tricresol. It is extensively used, in solutions of ¼ to 1 per cent., in gynecologic practice. It not only disinfects, but is an excellent detergent, and were it not so expensive, would be invaluable for the cleansing of bed-pans and like utensils.

Uses and Germicidal Power of Creolin.—Creolin is sometimes used for the irrigation of suppurating wounds and as a deodorant. For the former purpose, 1 to 2 per cent. solutions are usually used. It has about the same germicidal power as carbolic.

Preparation of Solutions.—The cresols are best diluted with water at a temperature of 98° to 100°. In preparing creolin, the water should be poured into the bottle first and it must not exceed 100° F. If it does, the drug will be too thoroughly dissolved and its strength thus impaired.

Formalin

Nature.—Formalin consists of a solution of formaldehyd gas. The origin and nature of this gas will be discussed under gaseous disinfectants, page 60; it is soluble in water up to 40 per cent. Formalin, like most gaseous solutions, is unstable and, unless the bottles containing it are kept tightly corked, its strength will be diminished. Formalin is not toxic, but the gas which passes from it is exceedingly irritating to the eyes and to mucous membranes.

Germicidal Power.—A 4 per cent. solution of the 40 per cent. solution will kill non-spore-forming organisms in ten minutes and spores in one hour. Formalin is antiseptic in very weak solutions—1 in 25,000 to 1 in 50,000.

Uses.—Formalin is very valuable in the disinfection of excreta for the reason that it is not only a disinfectant but also a deodorant. Formalin does not bleach colors nor diminish the strength of cotton, linen, silk, or woolen fabrics, but it unites with the organic matter of leather and furs and thus renders them brittle; therefore, it cannot be used for the disinfection of the two last named articles. Hot formalin solution injures iron and steel, but not other metals. Being non-poisonous, formalin is often used for the disinfection of fruit and nuts coming from plague and cholera stricken countries. These are dipped in a 5 per cent. solution. This treatment does not injure their taste. Formalin is also often used as a preservative for milk —a very minute trace of the formalin will inhibit the development of bacteria for a long time. Its use, however, for the reasons given on page 40, is illegal. It is not much used for the preservation of food that

is to be kept for any length of time because it is so volatile that it will be present only for a few days.

Hydrogen Peroxid or Dioxid

Nature.—Hydrogen peroxide is an aqueous solution of oxygen. It breaks down very readily into water and oxygen, and its disinfecting properties are due to the oxygen that is liberated. Light, heat, and the presence of decomposing organic matter hasten its decomposition. It must, therefore, be kept tightly corked and in dark bottles.

Uses.—In addition to its germicidal action, the oxygen set free from the hydrogen peroxid unites with and destroys masses of infected matter and suppurating tissue; hydrogen peroxid is therefore frequently used in the treatment of suppurating wounds and, in dilute solutions, for the cleansing of the throat in diphtheria, and for the removal of sores from the mouths of fever patients. The effervescence that follows its injection into wounds brings the suppuration products to the surface and this is removed with gauze sponges and by irrigating the wound with salt solution or other antiseptic; thus peroxid helps to clean the wound.

Iodin

Value.—At the present time an alcoholic solution of iodin is being very generally used as a pre-operative skin disinfectant. One of its chief values for this purpose is that it penetrates the skin and therefore accomplishes more than a surface disinfection, which is not the case with most disinfectants.

Strength of Solution.—The strength of iodin

solutions generally used for disinfectant purposes is from 3 to 7 per cent. When the stronger solutions are used the iodin is washed off with alcohol in from three to five minutes, but when a 3 per cent. solution is used it is generally not removed.

The methods of using iodin will be described in Chapter XX.

Lime

NATURE.—Lime or calcium oxide is obtained by removing carbon dioxide from calcium carbonate substances, *e. g.*, chalk, limestone, marble.

PREPARATIONS.—The preparations of lime commonly used as disinfectants are calcium hydrate, whitewash, milk of lime, chlorinated lime, and calcium hypochlorite. Calcium hydrate—*slaked lime*—is prepared by adding one pint of water to two pounds of lime. Whitewash is slaked lime mixed with water. Milk of lime is slaked lime mixed with about four times its volume of water. Chlorinated lime, known also as bleaching powder and, erroneously, as chlorid of lime, is obtained by passing nascent chlorin gas over moist unslaked lime. Calcium hypochlorite is similar to chlorinated lime.

NECESSARY CARE OF LIME PREPARATIONS.—Air must be excluded from all these lime preparations. The three first mentioned, if exposed to the air, will absorb moisture and carbon dioxid, and thus be converted into calcium carbonate, which has no disinfectant power. These disinfectants are much more powerful when freshly prepared, and are very inefficient after twenty-four hours. The chlorin preparations of lime, if exposed to the air, will lose their

chlorin and absorb moisture and thus be rendered useless. A pasty appearance of the preparation and strong odor of chlorin shows that decomposition of the substance is taking place.

Uses.—Whitewashing is often used for the disinfection of barns, poultry houses, and the like. Slaked lime and milk of lime are cheap and destroy both organic matter and bacteria. They are, therefore, very good disinfectants for excreta. Chlorinated lime is used both in powder form and in solution. It and calcium hypochlorite are used for the disinfection of cellars, privies, bed-pans, and other utensils. The former is sometimes used for the disinfection of the hands and of white cotton and linen clothing, etc.; also for the bleaching of white clothing. The care necessary in using these disinfectants with clothing will be referred to in Chapter IV. These disinfectants are also deodorants but the chlorin gas which passes off, and to which both the disinfecting and deodorizing properties are partly due, has a very unpleasant odor and is very irritating to the eyes and mucous membrane of the air-passages.

Germicidal Power.—When milk of lime is used for the disinfection of excreta, the material being disinfected must stand two hours before being emptied. Chlorinated lime in a 5 per cent. solution will, it is claimed, kill non-spore-bearing bacteria in five minutes and spores in one hour. When using slaked lime or the powdered chlorinated lime for the disinfection of excreta, the powder should be mixed thoroughly with the excreta, and sufficient disinfectant must be used to render the mass a 5 per cent. solution. Used in this strength, the powders will have the same degree of efficiency as the chlorinated lime solution.

The hypochlorite solutions are somewhat less efficient than the chlorinated and more expensive.

Labarraque's Solution

Nature and Uses.—Labarraque's solution consists of a combination of several chlorin compounds, chiefly sodium, hypochlorite, and sodium chlorid. Its germicidal properties depend upon the chlorin gas set free. Its uses are the same as chlorinated lime, but it is more expensive and rather less efficient as a germicide.

Permanganate of Potash

Germicidal Power.—Permanganate of potash depends upon the oxygen, which is easily set free from it, for its microbicidal action. It has been found that, under favorable conditions, a 1 per cent. solution of permanganate will destroy non-spore-bearing organisms in two hours and that a 5 per cent. solution will destroy spores in one day.

Uses.—Though permanganate of potash is a powerful microbicide its use is limited, for the reasons that it is easily reduced, and thus rendered inert, by organic matter such as albumin, that it stains fabrics, and is expensive. Its chief uses are (1) as a gargle and mouth wash, in a solution of 1 per cent., (2) for vaginal douches, usually in a strength of 1 per cent., (3) for the irrigation of gangrenous ulcers, in gonorrheal infections, and, occasionally, of suppurating wounds, in 1–3 per cent. solution, (4) for the disinfection of the hands, in a 3 per cent. solution. Permanganate stains the hands brown. Its use is therefore followed by that of a solution of

oxalic acid. Permanganate stains can be removed from white fabrics with a solution of oxalic acid, muriatic acid, or lemon juice. Formerly, permanganate of potash was used for the purification of water, but its expense, the danger of poisoning by the use of too large amounts, and the much greater efficiency of boiling have led to the discontinuance of its use for this purpose. It has slight deodorizing properties and supersaturated solutions are sometimes exposed in open dishes in rooms where the odor cannot be rectified by ventilation.

Silver

PREPARATION.—Two forms of silver in common use as local disinfectants are argyrol and silver nitrate. The former is a preparation of silver and yolk of egg, the latter, of silver and nitric acid.

GERMICIDAL ACTION.—Both these forms of silver have decided disinfectant properties. Silver nitrate in solid form—silver nitrate stick—is used to remove exuberant granulations, but its value in this case is due to its astringent and caustic action, and not its disinfectant properties. Mitigated silver nitrate, which consists of silver nitrate and potassium nitrate, is used to touch granulations on the eyelids. Solutions of silver nitrate 2 to 5 per cent. and argyrol 5 to 10 per cent. are painted on ulcerating mucous membranes and are used in the treatment of ophthalmia, especially that due to gonorrheal infection. Also, it is the routine treatment in many obstetrical hospitals to introduce one or two drops of either of these preparations into the eyes immediately after birth as a prophylactic measure to prevent ophthalmia. In giving such

treatment great care must be taken not to introduce more than the required number of drops. Diluted solutions of both these silver preparations are used for irrigation in the treatment of gonorrheal infection of the genito-urinary tract.

Dilution of Silver Solutions.—Only distilled water should be used for diluting silver preparations, because even filtered water contains some sodium chlorid and silver has such a strong affinity for chlorin that, if there is any chlorid salt in the water, decomposition of the two salts takes place and the silver combines with the chlorin to form silver chlorid, which will be useless for the purpose of the treatment.

Sodium Compounds

Sodium Hydroxid (Caustic Soda).—A 1 per cent. solution of caustic soda will kill vegetative microörganisms in a few minutes and a 4 per cent. solution will destroy spores in forty-five minutes. Sodium hydroxid is, however, little used as a disinfectant, for it is very destructive to fabrics and the skin.

Sodium Carbonate (Washing Soda).—Sodium carbonate in a 5 per cent. solution will kill non-sporulating organisms in a few minutes and a 5 per cent. solution, when boiling, will kill spores in five minutes. Sodium carbonate should be always used in the sterilization of instruments, for, as previously stated, it not only helps in their disinfection, but also prevents their becoming rusted and blunted.

Gaseous Disinfectants

Names.—The only two gases much used in gaseous form for disinfection are formaldehyd—a gas obtained

by the oxidation of wood alcohol—and sulphur. There are other gases that have equal, if not greater, germicidal action, but they are so poisonous and so destructive to fabrics that their use is attended with danger.

VALUE AND LIMITATIONS OF GASES AS DISINFECTANTS.—Gases lack the power of penetration and therefore cannot be depended upon for more than surface disinfection. They are, however, the ideal agent for the disinfection of rooms and houses, for the reason that they diffuse throughout a chamber and enter cracks and crevices that nothing but a gas could enter. Gas, on account of its lack of penetration, cannot be depended upon to disinfect mattresses that require more than surface disinfection, and all bedding and clothing that is to be disinfected must be hung up and arranged so that the fumes of the gas will reach every surface. To be efficient, both formaldehyd and sulphur require the room to be of a temperature of 25° C., 77° F., or over, and the atmosphere must contain at least 75° moisture.[1]

GERMICIDAL POWER.—Bacteria are killed almost instantly when exposed to a concentrated volume of formaldehyd gas and spores are killed within an hour. However, in fumigating rooms, a much longer time is required, because the gas is evolved slowly from most forms of apparatus and considerable time is required for it to penetrate to all parts of the room, also some germs may be embedded in dust or other matter and thus somewhat protected from the influence of the gas. Many experiments have shown that the time necessary to thoroughly disinfect a room depends very

[1] The method of using formaldehyd and sulphur gas for disinfection and the necessary preparation of rooms for such disinfection will be described in Chapter XXV.

considerably upon the way in which the gas is generated. With the majority of methods it is well to leave the room closed for at least twelve hours. Formaldehyd, being non-poisonous, will not kill many of the lower forms of animal life. It seems to have no effect upon bedbugs, roaches, and the like. It will kill mosquitoes if (1) it is generated in such a way that large volumes of the gas are evolved at once, (2) if the room is very tightly sealed—mosquitoes can escape through an incredibly small space,—and (3) if there is nothing present, *e. g.*, curtains, clothing, and bedding, in which the mosquitoes can hide from the direct contact of the gas. As the germicidal action of the gas depends upon its union with the protein substances of the germs and mosquitoes, direct contact with them is necessary for their destruction.

Germicidal Action of Sulphur Gas.—Sulphur is one of the most efficient insecticides known. It will kill mosquitoes quickly and will do so even when they are hidden in curtains, clothing, and the like. Sulphur, however, is not quite so efficient a germicide as formaldehyd, for it will not destroy spores, but in the presence of moisture and a high temperature it will kill sporeless organisms.

Comparative Value of Formaldehyd and Sulphur Dioxid Gas.—Formaldehyd gas does not change colors, except a few delicate lavender shades, neither does it destroy paintings nor fabrics, nor, in the gaseous form, metals. Formaldehyd gas is not poisonous; its fumes are very irritating to the eyes and mucous membranes but injurious exposure can easily be prevented. Formaldehyd is not an insecticide. Sulphur, on the other hand, is an insecticide, but not as efficient a germicide; it is poisonous; it destroys

all colors due to vegetable dyes and many anilin dyes. It injures nearly all metals by combining with them.

Antiseptics

All disinfectants in dilute solutions are antiseptics; in addition to these there are other chemicals that as ordinarily used have antiseptic action only. Two such antiseptics very generally used are boracic acid and physiological salt solution.

Boracic Acid

Nature.—Boracic acid, known also as boric acid, is made by the action of sulphuric acid on the sodium compound known as borax or by the purification of the compound of the elements boron and oxygen known as *boric acid*, which is found in certain mineral springs in Italy. It is usually bought in the form of a white crystalline powder.

Preparation of Solution.—Boric acid powder is very insoluble in cold water, therefore boiling water should be used when preparing solutions. A saturated solution, *i. e.*, one containing as much of the solid as the water, at ordinary temperature, can hold in solution, has a strength of 4 per cent.

Uses of Boric Acid.—This antiseptic, being non-irritating to the mucous membrane in solutions under 4 per cent., is very widely used for bladder, eye, ear, and nasal irrigations; also, it is used for washing the mouth and it forms a part of many of the compound solutions used for these purposes. It is generally used in a 2 per cent. solution. Another use of boric acid is that of a preservative; it is very often added to milk

and other food in order to prevent their becoming sour or decomposed. Whether the habitual use of foods preserved by the use of boric acid is likely to prove deleterious to health has been very much discussed. The more common opinion of investigators is that while no preservative should be added to food, unless it is absolutely unavoidable, boric acid is less liable to derange the health than the majority of chemicals used as preservatives. The quantity of acid used must, however, be small and foods so preserved should not be given to young children nor to invalids. The objection to the use of food preservatives was discussed on page 40.

Physiological Salt Solution

USES.—The solution of sodium chlorid—common salt—known as physiological or normal salt solution is very much used (1) to supply the body with extra fluid,[1] (2) for the cleansing of wounds, (3) for the irrigation of the bladder, ear, nose, and throat, and (4) for vaginal douches. The reason why it is so much used for irrigations is, that it is not irritating to mucous and serous membranes and to animal tissue, which is not the case with water and many of the other antiseptics and the disinfectants. It is used in wounds for the same reasons and also because it is thought that it has a slightly stimulating effect upon the tissues of a wound. It is used to supply the body with extra fluid because it can be even injected into the blood stream in comparatively large quantities

[1] The ways in which it is used and the conditions requiring its use will be described in Chapters XXII and XXIII.

without injuring the red blood-corpuscles, and other salts cannot be so used.

Strength of Solutions.—Physiological salt solution consists of an aqueous solution of $\frac{9}{10}$ of 1 per cent. sodium chlorid, *i. e.*, 9 parts in 1000. This is just slightly higher than the per cent. of sodium chlorid present in the blood.

Reason for Names.—Salt solution of from 0.6 to 0.9 per cent. was named physiological and normal salt solution because it has about the same specific gravity as the blood serum and for this reason as well as because it is one of the principal salts always present in the blood it can be used for injection into the veins without causing hemolysis, *i. e.*, disintegration of the red blood-corpuscles.

Method of Making Solution.—Dissolve 9 grams (2¼ drams) of salt in a liter of sterile filtered water and filter it. To filter, line a funnel with filter paper, place the funnel in a flask or bottle, and pour the salt solution in, a small amount at a time, allowing it to filter slowly through. When preparing the solution for subcutaneous or intravenous use, it must be refiltered until it is perfectly clear, which is usually about five times. When the filtering is finished, make a large, sterile non-absorbent cotton plug for the flask, or bottle, and bandage it in place. This not only provides a germ-proof stopper, but keeps the rim of the flask free from dust. The solution is best sterilized by steam under pressure. If steam without pressure is used, the sterilization must be repeated, as in the case of dressings, on three successive days. In an emergency, the sterilization can be done by placing the flask in a kettle of water, and letting it remain there half an hour after the solution has been

brought to the boiling point. The flask should never touch the bottom of the kettle or it will break. This may be prevented by placing a pad made of a few thicknesses of old muslin or gauze under it. Great care must be taken when measuring salt for normal salt solution because if the solution contains too much salt it will extract water from the tissues, be irritating to mucous membranes, and, if used for intravenous infusion, it will extract water from red blood-corpuscles and cause them to shrivel up; if, on the other hand, a solution very much too dilute enters the blood, its specific gravity being lower than that of the blood-serum, it will pass into red blood-corpuscles and cause them to swell and rupture.

The Preparation of Solutions

In estimating the amount of drug to use in making solutions either the apothecaries' or the metric system of weights and measures is used.

Apothecaries' Weight

20 grains = 1 scruple
60 grains = 3 scruples or 1 dram
480 grains = 24 scruples, 8 drams, or 1 ounce

Apothecaries' Measure

60 minims	= 1 fluid dram
8 fluid drams	= 1 fluid ounce
16 fluid ounces	= 1 pint
2 pints	= 1 quart
4 quarts	= 1 gallon

THE METRIC SYSTEM.—The metric system of weights and measures, being more convenient and accurate than the apothecaries' system, is now gradually being adopted in this country as the standard in all scientific work.

It originated in France in 1795, and has been accepted in all European countries, except England, where, as in this country, it is still optional.

The meter is the unit of length, the gram of weight, and the liter of volume. A meter is the ten-millionth part of the distance from the equator to the north pole. A gram represents the weight of a cube of water at its greatest density (*i. e.* 4° C.) each side of which measures one centimeter or one hundredth part of a meter. A liter represents the volume of a cube of water (4° C.) each side of which measures one decimeter (*i. e.* one-tenth of a meter).

The prefixes, deca, hecto, kilo, derived from the Greek, are used to denote increases, and the prefixes deci, centi, milli, derived from the Latin, are used to denote decreases, thus:

Millimeter	=	0.001	of a meter
Centimeter	=	0.01	of a meter
Decimeter	=	0.1	of a meter
Meter	=	1.	principal unit
Decameter	=	10	meters
Hectometer	=	100	meters
Kilometer	=	1000	meters
Myriameter	=	10,000	meters

The cube of a centimeter is called a cubic centimeter and its symbol is 1 c. c. With the exception of

the centimeter the names denoting decrease are rarely used; *e. g.*, instead of saying 1 decimeter we say 10 cc. Also in stating capacity the word meter is frequently used instead of liter for the subdivisions; *e. g.*, the expression centimeter is used instead of centiliter.

Approximate Value of Metric Fluid and Apothecaries' Measures

Cubic Centimeters		Fluid Ounces	Cubic Centimeters		Fluid Minims
1000	=	33.81	4	=	64.8
500	=	16.90	1	=	16.00
100	=	3.38	0.09	=	1.46
30	=	1.01	0.05	=	0.81

Approximate Value of Apothecaries' and Metric Fluid Measures

1 quart	=	946.00 c. c.
1 pint	=	473.11 c. c.
1 ounce	=	29.57 c. c.
1 dram	=	3.75 c. c.
1 minim	=	0.06 c. c.

Comparative Value of Metric and Apothecaries' Weights

Grams		Grains	Grams		Grains
0.0010	=	$\frac{1}{64}$	5	=	77.16
0.0065	=	$\frac{1}{10}$	10	=	154.32
0.0081	=	$\frac{1}{8}$	100	=	1543.23
1	=	15.43	1000	=	15,432.35

COMPARATIVE VALUE OF APOTHECARIES' AND METRIC WEIGHTS

1 grain	=	0.065 gram
15.5 grains	=	1. gram
1 ounce	=	31.10 grams
12 ounces	=	373.23 grams

Methods of Reckoning the Amount of Drug Necessary to Use in Making Solutions

HOW TO RECKON THE AMOUNT OF DRUG TO USE IN MAKING A SOLUTION OF A GIVEN PERCENTAGE.—(1) Using Apothecaries' Measure—According to the apothecaries' measure, there are 480 minims or grains in the ounce, but, to facilitate reckoning, in the making of solutions, the ounce is generally considered as having 500 minims or grains. Therefore, as 1 per cent. means one part in a hundred, to make an ounce of a 1 per cent. solution 5 minims or grains of the drug will be required, and to find out how much to use to make higher per cents all that it is necessary to do is to multiply the required per cent. by 5. Thus:

To make a 2 per cent. solution 10 grains are required
To make a 5 per cent. solution 25 grains are required
To make a 10 per cent. solution 50 grains are required

When it is required to make more than 1 ounce, multiply the amount of drug necessary to make 1 ounce by the number of ounces required; thus, to make 1 quart (32 ounces) of a 2 per cent. solution there will be needed 320 grains ($5 \times 2 = 10$ and $10 \times 32 = 320$). (2) Metric System—In the metric system the per cent. specified gives the amount of drug neces-

sary to use for every 100 cubic centimeters (c. c.) of solution. Thus 1 grain is necessary for 100 c. c. of a 1 per cent. solution; 3 grains for 100 c. c. of a 3 per cent. solution, and so on. To find out how much of a drug to use to make larger quantities than 100 c. c. multiply the per cent. by the number of hundred cubic centimeters wanted; thus to make a liter (1000 c. c.) of a 5 per cent. solution, it will require 50 grains, because $5 \times 10 = 50$.

Table Showing the Amount of Drug to Use in Making One Pint of Solution, the Pint Being Considered as Containing 8000 Grains, or 500 Grains to the Ounce.

Per Cent.	Which is Equivalent to	Amount of Drug
¼	1 part in 400	20.00 grains
½	1 part in 200	40.00 grains
1	1 part in 100	80.00 grains
2	1 part in 50	160.00 grains
3	1 part in 33⅓	240.00 grains
4	1 part in 25	320.00 grains
5	1 part in 20	400.00 grains
10	1 part in 10	800.00 grains
20	1 part in 5	1600.00 grains
25	1 part in 4	2000.00 grains

The Thermometric Scale.—It is sometimes necessary to change a given degree Fahrenheit—the scale generally used in this country—to centigrade—the French system—and vice versa. This is done as follows: To change from Fahrenheit to centigrade, subtract 32 from the given degree, divide the result by 9, multiply the result by 5, thus:

$$212 - 32 = 180 \div 9 = 20 \times 5 = 100$$

To change from centigrade to Fahrenheit, divide the given degree by 5, multiply the result by 9, and add 32. Thus:

$$100 \div 5 = 20 \times 9 = 180 + 32 = 212$$

Laboratory Methods

The following short description of laboratory methods is not designed to be a guide for laboratory work, but merely to give the student some idea of the methods used in studying and discovering the micro-organisms that are so necessary to life and yet cause so many of the serious diseases to which mankind is subject.

Important Points to be Considered in Studying Bacteria.—As there are hundreds of varieties of bacteria, it can be easily appreciated, from what has been already said regarding the small differences in their shape and nature, that it will be necessary to study all their characteristics carefully in order to distinguish one variety from another. Some of the important points that the bacteriologist has to consider are: (1) In what kind of media the organisms grow best. (2) If they cause putrefaction or fermentation or produce gases, acids, colored matter, or phosphorescence in the media; if they liquefy the latter. (3) If, and by what, they can be stained. (4) Whether they require oxygen or not. (5) Whether they have the power of independent movement. This can be told only by examining them under the microscope. (6) Their shape and size. (7) Whether they develop enzymes. (8) The results following their injection into animals, as rabbits and guinea-pigs. (9) Also,

there are different tests used for diagnostic purposes; familiar examples are the Widal and the Wassermann tests. The former will be described on page 76.

NECESSARY PRECAUTIONS IN LABORATORY WORK.—It can be easily understood that if accurate results are to be obtained in laboratory work the greatest care

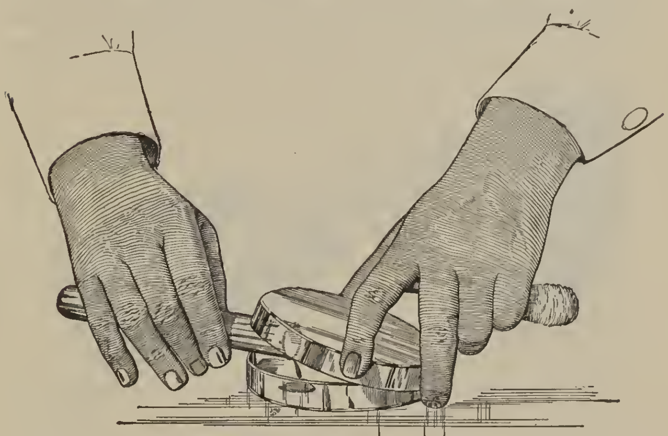

Fig. 2.

must be taken to have, and keep, everything that comes in contact with the specimen being examined perfectly sterile. For this reason slides[1] and cover glasses[2] are handled with sterile forceps rather than the fingers; when transferring media from a test-tube to a Petri dish, the tube and dish are held as shown in Fig. 2 to avoid infection from the air; when inoculating media in test-tubes the neck of the tubes is held

[1] Small pieces of glass on which matter for inspection under the microscope is spread.

[2] Very small and thin pieces of glass used to cover the matter on the slide.

in a flame after the removal and before the reinsertion of the sterile cotton stoppers. The stoppers are held by the upper end as shown in Fig. 3; the part which will be reinserted in the tube must not touch anything. The position in which the tubes are held is shown in the same figure. A platinum wire mounted in a glass or metal handle is often used for transferring cultures from one tube to another. The wire is sterilized

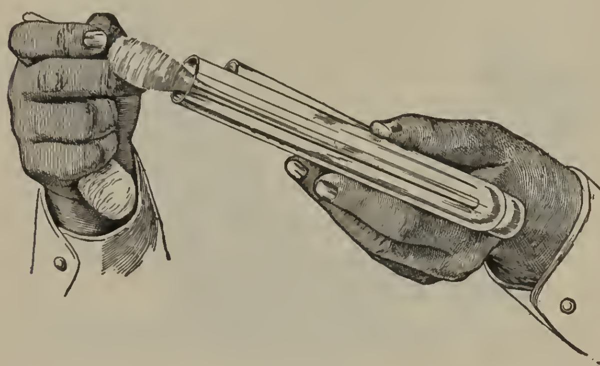

Fig. 3.

before use by holding it in a flame until it glows; it is then cooled, as otherwise it would kill the bacteria. The platinum wire is sterilized again after use, before it is allowed to touch anything, to prevent it contaminating objects with which it comes in contact. For taking cultures from throats, infected sinuses, and the like, wooden applicators wound with cotton and sterilized within a glass test-tube stopped with cotton are used; these are sterilized or put into a receptacle for soiled surgical dressings immediately after use.

The Preparation of Culture Media—Culture media are preparations in which bacteria can be cul-

tivated. The more common of these are (1) preparations that have for their basis an extract or decoction of meat to which a small amount of peptone has been added, (2) blood-serum, (3) milk, and (4) potato. The media are used in both liquid and solid form. Either agar-agar[1] or gelatin is used for stiffening liquid media. The former is often preferred because gelatin does not remain solid at a temperature of 37° C., which is the degree of heat at which most pathogenic germs grow best, and, moreover, certain bacteria liquefy gelatin. Sugar is added to media that are to be used to discover if bacteria cause fermentation.

Object of Staining Bacteria.—Bacteria are stained for two reasons: (1) as they are colorless it is necessary to stain them in order to study them closely; (2) the variety of bacteria can often be determined by the way they are affected by staining agents. For instance, it is almost impossible to stain some bacteria without adding some agent to the staining fluid. When used for such a purpose, the substance is called a *mordant*. On the other hand, certain bacteria will not lose their stain even when treated with acids. Such bacteria are spoken of as acid-fast bacteria. The tubercle bacilli act in this way. Still other bacteria will hold their stain, even when the slide is washed first in iodine and then in alcohol and water. Those which do so are said to be *Gram*[2] *positive* and those which lose their stain when so treated are said to be *Gram negative*.

Method of Testing Gauze or Other Material to See if it Is Sterile.—A small piece of the material

[1] A seaweed found on the coast of Japan and China.

[2] The name of the bacteriologist who described this method of staining.

is put into a test-tube containing some sterile liquid bouillon, taking all the precautions described on page 71. The test-tube is then placed in an incubator where it can be kept in a temperature of about 98° F. (36.5° C.). If, at the end of twenty-four hours, the bouillon is still clear, the article therein must be sterile, but if the bouillon has become at all cloudy, the reverse is indicated.

To discover the nature of the bacteria which have caused the clouding, a platinum wire, the end of which is bent into a loop, is sterilized in the flame of a Bunsen burner as described on page 72. A loopful of the infected bouillon is then transferred to a tube of sterile, liquefied agar bouillon, taking the precautions against infection mentioned on page 71. The cotton plug, which acts as a cork, is replaced and the contents of the sterile tube is mixed by carefully tilting it back and forth, care being taken while doing this not to allow the liquid to come in contact with the plug. Then two loopfuls of this agar bouillon are transferred from this tube to a second tube of melted agar bouillon, and after this is mixed in the same manner as the first tube, two loopfuls are transferred from it to a third tube. The contents of the tubes are then one at a time poured into separate Petri dishes. In doing this the cotton plug is removed, the rim of the test-tube is passed through the flame and then inserted under the edge of the Petri dish cover, which is slightly raised as shown in Fig. 2. The Petri dish is then carefully tilted in such a way that the liquid will be evenly distributed over the bottom of the dish. The reason for making the three cultures is that if there were many bacteria in the original culture there would be too many to be able to study them properly

in the first agar culture, and in such case, conditions in either the second or third culture will probably be those desired.

After twenty-four hours, masses of bacteria are seen here and there on the solid medium. These masses are called *colonies* and there will be but one variety of bacteria in a colony. If the bacteriologist wishes to make special study of the bacteria on the medium, he will transfer a minute particle from each colony to separate test-tubes of media in much the same way as he made the original preparation. In this way he secures a *pure culture—i. e.*, he will have but one variety of bacteria growing in the culture.

Method of Preparing Bacteria for Examination under the Microscope.—If the bacteria are in liquid medium, a drop of the medium is placed on a sterile cover slip or glass slide by means of a sterile glass dropper or platinum loop. If the bacteria are in solid medium, a drop of sterile distilled water is placed on the slip and then, with a sterile platinum wire, a small speck is taken from a colony and mixed with the drop of water. The preparation is smeared over the center of the cover slip as thinly as possible; it is then allowed to dry in the air, and is afterward *fixed* by passing the glass two or three times through the flame of a Bunsen burner or alcohol lamp, or else by dipping it in absolute alcohol, formalin, or glacial acetic acid, washing off the chemical, and drying the slip as before. The preparation is then usually stained. This may be done by immersing the slip in the dye desired and allowing it to remain for about fifteen minutes, after which it is washed with clean water and dried between layers of blotting paper. It is then ready for use, or, if it is desired to keep the preparation, it is mounted in

balsam; *i. e.*, a drop of Canada balsam is dropped in the center of the smear and a cover glass placed over this and the two glasses pressed together gently.[1]

METHOD OF PREPARING A CULTURE OF LIVING BACTERIA FOR MICROSCOPIC EXAMINATION.—In the process of preparing bacteria for examination as just described, the bacteria are killed, therefore such a method will not do when it is necessary to determine whether the bacteria have the power of movement, of forming spores, and other properties that can be shown only by living bacteria, and the so-called *hanging drop* method is employed when making examinations to obtain such data. For this method a special slide, in the center of which there is a small circular depression, has been devised. If the bacteria have been grown in fluid medium a drop of this is transferred to a cover slip; if the bacteria are in a solid medium, a minute portion of a colony is mixed with physiological salt solution and a drop of this preparation placed on the cover glass, which is then inserted on the slide in such a way that the drop hangs into the depression in the slide; usually a little cedar oil is smeared on the slide around the edge of the depression before the cover glass is inverted. This holds the latter in place.

THE WIDAL-GRUBER TEST FOR TYPHOID.—Nurses are not expected to know how to do this test, but they

[1] When it is desired to examine pus, sputum, or other exudate under the microscope, a tiny part of the material is smeared on the slide. The rest of the preparation is the same as described above.

There are many more complicated methods of staining used for diagnostic purposes, a description of which will be found in almost any of the bacteriologies mentioned in the bibliography at the end of this book.

should know something of its nature, because it is so much used and so frequently referred to.

The test is based on the fact that the blood serum of a person who has typhoid will, in the vast majority of cases, cause agglutination[1] of the bacilli that cause typhoid fever. One method of doing the test is, omitting details, about as follows: A drop of blood is taken from the lobe of the ear or tip of a finger of the suspected patient onto a sterile glass slide or into a small, sterile, glass capsule. This is diluted, usually with salt solution, and added to a liquid culture of typhoid bacilli in the proportion of about 1 part of the suspected serum to 50 parts of the typhoid culture. From this mixture a hanging drop preparation is made and examined under the microscope. If the patient has typhoid fever the bacilli nearly always lose their power of motion and collect in clumps. If the patient has not typhoid, this agglutination does not take place.

Another test often referred to is the *Wassermann test*. This is, however, too complicated to be described here. It is used for the diagnosis of syphilis.

Method of Getting Specimens of the Bacteria Present in a Room.—A Petri dish containing sterile agar bouillon medium is exposed in the room for a few seconds; it is then covered and cared for as described on page 75.

Throat Cultures.—A nurse is very often required to take a throat culture. The articles required will be an alcohol lamp, a sterile swab (this usually consists of a thin pencil-like piece of wood with a small piece of cotton wound around one end; in the hospital,

[1] An aggregation or clumping of the bacilli into clumps or masses.

this is usually sterilized in a glass test-tube corked with cotton and kept in this until required); a test-tube containing the medium—solid medium, that has been solidified with the tube in a slanting position so as to obtain a larger surface of medium for inoculation, is usually used.

The procedures are as follows: Place the patient in a good light; touch the affected part—the patch if one is present—with the sterile swab, being very careful not to let it come in contact with any other part of the mouth or throat; remove the plug from the culture tube, insert the swab, being careful not to touch the rim or sides of the tube, rub the swab gently over the slanting surface of the medium, from the bottom up; pass the rim of the tube through the flame; insert the plug; replace the swab in its own tube. The plugs must be removed from the tubes and held as described on page 71. The tubes should be held as shown in Fig. 3. The precautions given on page 72 regarding the care of the swab must be remembered; should it touch anything before it is used the culture may not be true; if afterward, and the patient has diphtheria, anything the swab touches may become a source of infection.

Collection of Water or Milk for Bacteriologic Examination.—When a nurse is doing private nursing, she is sometimes asked to send a specimen of water or milk to a laboratory for examination. To do this she should sterilize a bottle—unless the size is specified, one that will hold about six ounces is usually used—and obtain some sterile cotton; a small package can be bought for a few cents at any druggist's. In obtaining a specimen of water the following points are to be remembered: The water must be

allowed to run from the faucet for some time before collecting, the bottle must not touch the faucet. It must be stoppered immediately with sterile cotton, and must be sent to the laboratory at once.

The special points to be observed in collecting a milk specimen are: The milk and cream are to be thoroughly mixed, using a sterile utensil for the mixing; it is to be poured directly from the bottle or can in which it was received from the milkman. The specimen should be secured and sent to the laboratory as soon after the milk is received as possible.

The methods of obtaining sterile specimens of excreta will be described in Chapter IX.

When securing specimens, it must be remembered that if the material to be examined becomes contaminated from outside sources it is useless for its purpose. To prevent contamination, thought and watchfulness are necessary.

CHAPTER III

VENTILATION

Nature and Composition of the Air, Atmospheric Pressure, Moisture. Impurities in the Outdoor Air and their Causes. Factors which Prevent Accumulation of Impurities in the Air. Causes of Air Contamination within Doors. Changes Caused in the Air by Respiration. Impurities Due to Perspiration and to Combustion. Result of Air Contamination upon the Health. Reason for Such Results. Measures Necessary to Prevent Air Vitiation. Amount of Air Space Required per Capita. Methods of Ventilation. Physical Properties of Gases upon which Ventilation Depends. Care Necessary to Prevent Air Contamination within Doors.

A PLENTIFUL supply of fresh air is an important factor in the treatment of disease. It is a well-known fact that soldiers cared for in open tents, in time of war, have recovered under the most adverse circumstances, when food, medicine, and nursing have all been most meager. This result has been credited to the great quantity of fresh air and sunlight with which they were unavoidably provided, and of which patients in hospitals and sick-rooms, where everything else is furnished in abundance, are too often deprived. The gradual realization of the curative properties of fresh air and sunlight is leading, year by year, to the opening of new sanatoria specially equipped for open-air treatment, and to the addition to hospitals of sun-rooms and rooms connecting with

wide verandas so arranged that the beds can be wheeled through the window. In cities the roofs of hospitals and dwelling-houses are being utilized for this purpose.

Before taking up the subject of ventilation it may be well to consider briefly the composition of air, the sources of air contamination, without and within doors, and the factors upon which the purification of the air out of doors depends.

The Air

NATURE.—The atmospheric air is a colorless, odorless, transparent, gaseous substance. Though invisible, air possesses weight and, therefore, it exerts pressure. Under ordinary conditions, we are unconscious of this pressure or weight, and even of the presence of air, but when the air is in rapid motion, as in a wind storm, or when we are moving very rapidly, we appreciate that we are surrounded by a medium that exerts great pressure and that can offer very forcible resistance.

PRESSURE.—The pressure that the air exerts varies at different altitudes and at different temperatures, but it is at all times surprisingly large. At the sea level, when the temperature is 32° F., or 0° C., the average degree of pressure is sufficient to support the column of mercury in a barometer 760 millimeters in height, and it exerts a weight of a little over a kilogram per square centimeter, or 14.7 pounds per square inch; thus an average-sized man at sea level supports a weight of about 18,000 kilograms.[1] Atmospheric

[1] This weight, though great, is unnoticed because it is equalized by the internal pressure of the body.

pressure decreases as we ascend above the level of the sea, and increases as we descend below its level, because the pressure exerted by a gas is proportional to its depth, and naturally when on a high mountain the depth of air above us is decreased by several miles.[1] Atmospheric pressure is influenced also by temperature and by the amount of moisture in the air. It is increased by cold, because cold causes the lower strata of air to become contracted and dense, and it is decreased by heat, because heat causes air to expand so that it becomes less dense and thus there is less air in the space and consequently the remaining mass is lighter and exerts less pressure. The greater the amount of moisture in the air, the less will be the pressure, because the watery vapor is lighter than air. This is why a sudden *fall of the barometer* precedes a rain-storm, the air before a storm being saturated with moisture; see page 83.

Chemical Composition of Air.—The principal gases of which air is composed are: nitrogen in the proportion of about 79 parts, by volume; oxygen 20.96 parts; carbon dioxide, 0.04 parts. There are also several other elements as argon and ozone present in very small amounts and a varying amount of aqueous vapor. The gases composing the air are not held in chemical combination with each other, but exist more as a homogeneous mixture.

[1] Severe change of air pressure, as experienced at high altitudes, causes increased heart action, rapid respiration, and sometimes headache, vertigo, vomiting of blood, and even death. Change to descent below sea level, as in diving-bells and tunnels under rivers, is even more likely to cause death because the increased pressure causes the sudden liberation of gases in the tissues and blood, which interferes with the heart action.

Moisture.—The average amount of vapor in the air is about 1 per cent., but it may vary from somewhat less than this to about 4 per cent. When the air in any locality has as much water as it can hold, it is said to be *saturated*, and when sudden cooling occurs, the water is precipitated in the form of dew, rain, hail, or snow. When the air is completely saturated, the relative[1] degree of saturation is said to be 100 per cent. The proportion of relative saturation generally considered to be the most pleasant is from about 70 to 75 per cent.

Impurities of the Air out of Doors and Their Causes.—The impurities in the air may be either gaseous or solid; they vary greatly in different localities, both in nature and amount. In all places, carbon dioxide is being generated continuously as the result (1) of the combustion taking place in stoves, furnaces, and the like; (2) of the oxidation that is constantly going on in all animal bodies; (3) of the decomposition of vegetable and animal matter. The greater the amount of carbon dioxide that is being formed, the greater the amount of oxygen that is being used, for since carbon dioxide is the product of the oxidation of organic matter and all forms of oxidation[2]

[1] The amount of aqueous vapor which a volume of air contains constitutes its *absolute humidity*. By *relative humidity* is meant the amount of moisture present in the air, expressed as a percentage of the amount just necessary to cause saturation.

[2] When oxidation takes place so rapidly that light and intense heat are produced, it is spoken of as combustion. Decomposition is a form of slow oxidation brought about by the influence of bacteria or ferments. It is attended by the production of a small amount of heat. The oxidation that goes on in the animal body is largely the result of ferments made in the body. It produces the heat and energy necessary for life.

consist of the union of oxygen with compound substances, and their consequent disintegration into simpler substances, oxygen is of course necessary for the process. Many other impurities, such as carbon monoxide and various sulphur and ammonia compounds, arise as the result of the various forms of oxidations, and in localities where there are mills, factories, and the like, or where there is much decaying animal or vegetable matter, or where sewers are defective, these impurities will be increased a hundred-fold. The most important solid matters in the air are sand, dust, soot, products of street refuse, microörganisms of all kinds, the pollen of various plants, and, where there are mills, factories, et cetera, substances derived from material that is being worked upon in the buildings.

Factors which Prevent Accumulation of Impurities in the Air.—In spite of the facts that oxygen of the air is being continually used up and that various impurities are being as constantly generated, the composition of air, except in the immediate vicinity of the contaminating influence, remains practically about the same. How can this be? There are several reasons. Some of the more important are: (1) The tendency of gases to diffuse or spread through space. (2) The action of the winds and breezes and the movement of the air from any cause. (3) Heat and cold—these must be mentioned in connection with air movement because the atmospheric movements that we designate as breezes, winds, et cetera, are dependent upon variations in the temperature of different strata of air and of the air in different localities.[1] (4) Rain, snow, et cetera. When the moisture in the air condenses and so forms dew, rain,

[1] See page 94.

or snow, it absorbs and holds in solution many of the impurities contained in the air and this carries them to the ground. The rain water of localities in which there is much atmospheric contamination is thus far from being the pure form of water that many persons consider it. (5) Plant life—this is a most important factor in the purification of the air, since all forms of growing plants that contain chlorophyll[1] absorb CO_2[2] and H_2O[3] from the air, and with the aid of the sunlight put the elements C, H, and O together to form glucose ($C_6H_{12}O_6$) and cellulose ($C_5H_{10}O_{5n}$), the woody fiber of plants. Now it can readily be seen that if 6 molecules of CO_2 and 6 molecules of H_2O combine to form 1 molecule of $C_6 H_{12} O_6$ there will be from every molecule of glucose made 12 atoms of O left over. In the forming of cellulose, also, there will be oxygen left over, and also in the construction of the fatty substances of the plants from the glucose, fats containing considerably less oxygen than glucose or cellulose. This oxygen is given off from the plants and is the chief, if not the only, source of oxygen supply. Sunlight being essential for the chemical reactions to which the development of plants is due, it is, ordinarily,[4] during daylight that plants are most active in their air-purification function.

[1] From the Greek *chloros* = green, and *phyllon* = a leaf; the name given to the green-coloring matter of plants.

[2] Carbon dioxide. [3] Water.

[4] It has been found that the electric light also is efficacious in producing chlorophyll in the leaves of plants and in promoting chemical activity and consequently growth. Strawberries, lettuce, and other fruits and green vegetables have been brought to maturity several weeks earlier than usual by keeping the greenhouse in which they were growing illuminated with electric light during the night.

Causes of Air Contamination within Doors.—The ordinary sources of air impurities within doors are respiration, perspiration, and combustion. Occasional causes are impurities in the air entering a room or building, defective plumbing, improperly cared for garbage and trash cans, dust and other forms of dirt. In hospitals dust and dirt of any kind are particularly likely to contain a large number of pathogenic bacteria and particles of epithelia and other excreta; in factories, mills, and the like, unless proper preventive measures are taken, the dust may be full of various finely divided substances derived from the material being worked upon, and in certain industries poisonous vapors or gases may be developed; *e.g.*, phosphorus, in the making of matches; arsenic, in the preparation of certain wall papers, of artificial flowers, and of skins for mounting. In hospitals and sick-rooms improper care of bed-pans and other utensils, carelessness in the handling and disposing of excreta, may add greatly to the contamination of the air.

Changes Caused in the Air by Respiration.—As previously stated, oxygen is being continually taken from the air in the act of respiration, in order to supply the body with the oxygen that it requires to keep up the oxidation that must go on unintermittently within the tissues in order to provide the body with the heat and energy necessary to keep its mechanism—the heart, lungs, et cetera—at work and allow of its external activities. Thus, one change in the air due to respiration is a diminution of its oxygen. In the act of expiration, the CO_2 resulting from the oxidation in the tissues is given off and thus the proportion of CO_2 in the air is increased. The expired air is nearly always saturated with moisture, a healthy adult

giving off in expiration about 286 grams—about 9½ ounces—of water in twenty-four hours, and thus respiration increases the humidity of the air; also it increases the temperature, since if a room is kept at a desirable temperature, the air taken into the lungs at each inspiration will be about 68° F., and that exhaled will be about 93° F. to 96° F. A varying quantity of organic gaseous substance, the nature of which is not exactly known, is given off in the respiration. Very little of this organic matter, it is thought, comes from the lungs. It is supposed to be derived chiefly from the mucous membrane of the pharynx, larynx, and mouth, from the stomach, and from particles of food lodged between the teeth. The quantity of organic substance exhaled is naturally much increased when the teeth are decayed. The quantity of nitrogen in the air undergoes little or no change, because atmospheric nitrogen is not concerned in the chemical reactions going on in the body, its main function being to act as a diluent and to prevent the too energetic action of the oxygen. Even iron will burn in an atmosphere of pure oxygen.

Impurities Due to Perspiration.—The amount of water which leaves the body daily in the perspiration is about two quarts and this quantity is much increased when a rise in the surrounding temperature or an unusual degree of body activity causes such a profuse perspiration that it can be seen as drops of water on the surface of the body. This water is vaporized, and passing into the air adds to its humidity. Other impurities that pass into the air from the skin are volatilized organic substances derived from the perspiration and from the sebaceous matter that passes from the sebaceous glands onto the skin.

Impurities Due to Combustion.—These vary both in nature and quantity according to the methods of lighting and heating. Thus, the principal impurities arising from coal, coke, petroleum, and gas are carbon dioxide and monoxide, various sulphur and ammonia compounds, and aqueous vapor. The principal impurities arising from wood are carbon dioxide, carbon monoxide, and aqueous vapor. From electric lights there are no impurities. The following table shows the effect of the various heating and lighting agents upon the room air:

Lighting Agent	*Quantity Consumed*	Candle Power	CO_2 Produced	Oxygen Removed	Moisture Produced	Heat Calories Produced	Vitiation Equal to Adults
			C. ft.	C. ft.	C. ft.		
Tallow candles	2200 grains	16	7.3	10.7	8.2	1400	12.0
Kerosene oil lamp	909 grains	16	4.1	5.9	3.3	1030	7.0
Coal-gas, No. 5 baturing burner	5.5 cu. ft.	16	2.8	6.5	7.3	1194	5.0
Coal-gas, Argand burner	4.8 cu. ft.	16	2.6	5.8	6.4	1240	4.3
Coal-gas (Welsbach incandescent)	3.5 cu. ft.	50	1.8	4.1	4.7	763	3.0
Electric incandescent light	0.3 lb. coal	16	0.0	0.0	0.0	37	0.0

Result of Air Contamination upon Health

Effect of the Usual Impurities Present in Poorly Ventilated Buildings.—Headache and general lassitude are the common results of remaining for any length of time in an overcrowded room or building in which the ventilation facilities are inadequate, and anemia, weakness, and general depression of the vital forces are the common consequences of constantly living in ill-ventilated rooms.

REASON FOR THESE RESULTS.—Formerly the effects produced upon the system by breathing vitiated air were laid to the excess of CO_2 and of the organic matter given off in the respiration and perspiration. This is not now generally believed to be the case, because chemical analysis of air taken from crowded buildings, as churches and theatres, has shown that unless there are unusual conditions present, as leaking sewer or gas pipes, or unless the rooms are occupied constantly, the air in these places does not contain as large a volume of CO_2 as 2 per cent., and various experiments have shown that if a room is kept cool—about 68° F.—and the accumulation of moisture prevented, no evil results will be felt from an increase of the CO_2 in the air until the gas occupies over 2 per cent. of the volume of the air in the room, and, if the room is supplied with extra oxygen, the carbon dioxide may increase to 4 per cent. and over before any appreciable ill effects are felt. As regards the organic matter, experiments have led to the conviction of the majority of experimenters, that since carbon dioxide is an odorless gas, the disagreeable odor that arises in a badly ventilated room is usually due to the products arising from the decomposition of the organic matter, but that this organic matter is non-poisonous to the animal organism, and that, therefore, if it does contribute to the feeling of ill-being, it must act solely through the sense of smell. This knowledge has led to the conclusion that the most important causes of the headache and lassitude consequent on presence in a badly ventilated room are the increased heat and the moisture, especially the latter, as it prevents the normal degree of evaporation of perspiration from the surface of the skin and thus interferes with heat regulation

(see page 251). The ill effects that follow constantly working and living in badly ventilated rooms are thought to be due to the above causes and to a lack of sufficient oxygen to provide the body with the amount that it requires to maintain a normal degree of oxidation in the body, in consequence of which the proper nutrition of the body is interfered with.

Effect of Gases Developed in Lighting and Heating.—Though the gases of which coal gas are composed are more or less poisonous to the animal organism, and a varying amount of these, escaping combustion, pass off into the air during the burning of the gas, when there are only a few lights burning, and proper ventilation is provided, the gases do not accumulate in sufficient quantity to affect the health. But in overcrowded rooms where there are many lights burning and the ventilation is poor, quite enough gas may accumulate to cause a slow chronic poisoning. The same thing is true of kerosene, especially if the oil is not pure, but the better grades of oil undergo more thorough combustion and consequently there are fewer gases to escape.

Effect of Sewer Gas.—When sewer gas escapes into the outer air, it is usually soon diluted beyond power to harm, but when it gains access to poorly ventilated houses, the result is far otherwise. Sewer gas will not, as was formerly thought, cause diphtheria and other infectious diseases, but people, especially children, who live in a house where defective plumbing permits of leakage of these gases into the building, are likely to become anemic and exhibit various symptoms of impaired health; also they lose their natural power of resistance to disease, and thus easily succumb to any infection they may contract.

Result of Impurities Characteristic of Some Industries.—The effect on the health of the various impurities resulting in certain industries varies according to the nature of the impurity. In some cases, the inhaled matter slowly poisons the system; in others, it acts as an irritant to the respiratory tract or the eyes, and may lead to various pulmonary affections or disease of the eyes. Solid impurities, if inhaled, will not only act as irritants, but will to some extent be deposited in the lung tissue, *e.g.*, on autopsy, portions of the lungs of miners have been found almost filled with fine coal dust. Naturally, such deposits interfere with the proper functioning of the lungs.

Measures Necessary to Prevent Air Vitiation.—Some of the more important measures necessary to prevent air vitiation and consequent ill effects on the health are:

(1) To have the room or building sufficiently large to provide the required amount of air space for each occupant.

(2) Proper ventilation.

(3) Proper sewage and lighting and heating arrangements.

(4) Cleanliness.

Amount of Air Space Required per Capita.—In reckoning the amount of air space that must be allowed per capita the fundamental things to be considered are:

(1) The amount of air passing into and out of the lungs in each respiration and the difference in the proportion of oxygen and carbon dioxide in the inspired and expired air. These matters have been found to be as follows: In ordinary respiration, an

average-sized man, doing a moderate amount of work, takes into his lungs at each inspiration about 500 cubic centimeters (30 cubic inches) of air and gives out an equal amount in each respiration. The average change in the proportion of oxygen and carbon dioxide in the expired air consists of a loss of about 4.94 volumes of oxygen and a gain of 4.38 volumes of carbon dioxide.

(2) The rate at which fresh air can be introduced into a room without causing a draught. This, experience has shown, depends very largely upon the perfectness of the methods of ventilation. With the average facilities for ventilation, it has been found that the introduction of sufficient outside air to change that in a room twice or three times in an hour is as much as can be done without causing a draught.

(3) The size of the people and the nature of their occupation. Large people naturally take more air into their lungs at a time than small people, but children in proportion to their size give off about twice as much carbon dioxide as adults. This is because oxidation goes on more rapidly in children than in adults, partly on account of the extra amount of chemical changes going on in the child as the result of growth, and partly due to the excessive energy that is characteristic of children. For this reason, though children need less actual air space than adults, they need more in proportion to their weight. With regard to the occupation of the people who are to occupy the rooms, the important point to be considered is, of course, the amount of air vitiation that is likely to occur, and extra space should be allowed wherever conditions exist that tend to promote air vitiation, as in factories and hospitals, and when rooms

or buildings are continually filled with a number of people, or where much gas or oil is burnt, or where the air is likely to become overheated from any cause.

The following table gives the space per capita that it has been found is required under different conditions to keep the air pure, when it can be changed by ventilation twice in the course of an hour:

	Cubic meters
Hospitals	30 to 50
Factories	30 to 50
Hall and Assembly Rooms	15 to 30
Theatres	20 to 25
Prisons	25
Barracks	15 to 25
Classrooms for Adults	12 to 15
Schools	7.5 to 10

According to these figures, if a room is ten or twelve feet high, there should be from 85 to 100 or more square feet of floor space allowed per person and an increase over this in hospitals and workshops.

Ventilation

Definition of Ventilation—Ventilation has been defined as *the continuous introduction of pure air into a room or building, the mixing of it with the contained air, and the simultaneous extraction of a like quantity of impure air.*[1]

Physical Properties of Gases upon which Ventilation Depends.—The two physical properties

[1] D. H. Bergey, A.M., M.D.: *Principles of Hygiene*, page 64. W. B. Saunders Co.

of gases upon which ventilation principally depends are diffusion and convection.

DIFFUSION.—When a room or a vessel is filled with several gases, which have no chemical affinity for each other, the gases do not arrange themselves in different layers according to their densities, but they intermingle, so that in time each gas is distributed uniformly throughout the whole space just as it would be were it the only gas present. This spreading of gases is known as *diffusion*.

CONVECTION.—Convection has been defined as *the transfer of heat by the transfer of the heated body itself.*[1] Convection of air is dependent upon the difference in the density of masses of air at different temperatures. For instance, when heated, air expands, and in so doing grows lighter and rises. The colder, heavier air consequently presses down under that which has been heated and buoys it up. The heating apparatus being, usually, near the floor, part of the colder air thus pressed down soon becomes hotter than the rest of the air and it in turn rises, pressing down some of the air above. Thus, difference in temperature keeps the air in constant movement and not only the ventilation but also the heating of rooms is largely dependent upon these so called *convection currents*.

EFFECT OF SUCTION ON VENTILATION.—Another physical force that is of importance in ventilation is that of suction. Suction, in connection with ventilation of rooms, results because as heated air expands it is forced to find an exit through every available crack and outlet, so it passes from a room not only

[1] C. Hanford Henderson, Ph.D., and John F. Woodhull, Ph.D.: *Elements of Physics*, page 182. D. Appleton & Company.

through the windows, doors, ventilators, and chimney, but even, to some extent, through the walls and ceiling, the material of which these are made being more or less porous. This loss of air from a room creates a partial vacuum—*i. e.*, a space which contains no material substance, and to fill this the outside air is sucked in.

Draughts.—The greater the difference between the temperature of the air entering a room and that contained in the room, the greater will be the degree and velocity of the movements of the air in the room. When the movement of air in the room is so great that it becomes perceptible to the inmates of the room, it is known as a *draught*.

Methods of Ventilation.—The different methods of ventilation are classed under two headings—*natural* and *artificial*. By natural ventilation is meant that which is obtained by means of windows, doors, and chimneys; by artificial, that which is induced by mechanical means.

Artificial Ventilation.

Different Kinds of Artificial Ventilation.—Artificial ventilation consists in either extracting air from, or forcing air into, a room or in both together. The methods by which air is extracted from a room or building are spoken of as the *extraction* or *vacuum system;* those by which air is pumped or forced into a room, as the *propulsion* or *plenum system*. Air is usually extracted from a room by means of fans placed either in the chimney or a special ventilating shaft, or by means of a special heating apparatus in the air outlet. Though the part the chimney plays in ventilation is

usually considered in connection with natural ventilation, the fire in the open grate is an example of a simple form of the extraction or vacuum system. See page 99.

How the Air is Changed in the Vacuum and Plenum Systems.—The extraction of air from a room or building creates a vacuum and this results in the outside air being sucked in through the openings provided for the purpose. In the plenum system. as just stated, fresh air is forced into the room or building by means of different forms of apparatus, and the air thus added forces some of that already in the room to leave through the apertures provided for the purpose.

Nurses' Duties in Connection with Artificial Ventilation.—Artificial ventilation is now very commonly employed in large buildings, such as hospitals, schools, etc. In hospitals, where it is used, the nurses have usually nothing to do with the regulation of the ventilating apparatus, unless the arrangements for opening and closing the ventilators are in the ward, but, in any case, the nurses are responsible for the ventilation, since they are the ones who must detect signs of air vitiation. To be able to do this at all times, it is necessary to cultivate the habit of, on entering a ward, noting if there is any odor present. The odor of the organic matter given off in the respiration and perspiration is easily detected if it is noted on entering a room, but people become accustomed to it surprisingly soon.

Natural Ventilation

Points to be Considered in Connection with

Natural Ventilation.—The regulation of the ventilation of the ward or sick-room by natural means is usually entirely the nurse's duty, and some of the important points that she must consider in order to secure perfect ventilation are:

(1) The source of the fresh air supply—the air entering a room can be quite as tainted as that within the room.

(2) The current of air entering a room must not be disagreeably perceptible to the inmates of the room. In other words, there must be no draught.

(3) In cold weather, the air entering the room should be directed upward.

(4) The inlet and outlet for the air must be so arranged that the entering air will have a chance to diffuse through the whole space of the room. This it will not do if the inlet and outlet are exactly opposite each other.

Location for Outlet and Inlet.—As previously stated, the air passing from the lungs is hotter than that inhaled, therefore the air passing from the body tends to rise to the upper part of the room. For this reason, when depending upon ventilation in which there is no forcible extraction or propulsion of air, it is generally thought to be better to have the outlet for air in the upper part of the room and the inlet at a lower level. Another reason for this arrangement is that when gas is used for illuminating purposes, the gas escaping oxidation, being heated, tends to rise, and if there is an outlet in the upper part of the room, it will escape and not become mingled with the air that is to be respired.

Arrangements in Natural Ventilation.—When the weather is too cold to allow of opening the windows

to any extent, it is often a very difficult matter to ventilate a sick-room properly. The following are some of the methods that can be adopted.

When there are two windows in a room at opposite sides and with double sashes, pull down the upper one of the outer sashes and raise the lower one of the inner sashes of the window through which it is desired to get the fresh air, and arrange the window on the other side of the room in the opposite manner, viz., pull down the upper one of the inner sashes and raise the lower one of the outer sashes. When the windows have not double sashes, a good plan is to place a narrow board beneath the lower sash of one window, so that the upper edge of the latter will be raised two or three inches above the level of the bottom of the upper sash. The air will then enter between the two sashes and be directed upward. In a sick-room, when no board can be had, pillows, a rolled blanket, or the like can be placed in front of the opening until a board can be procured. The opposite window is pulled down from the top; a mere crack will suffice if the weather is *very* cold and the window shade can be lowered enough to cover the opening. When there is only one window in the room and no fireplace, transom, nor ventilator of any kind, the lower sash of the window can be arranged with a board and the upper sash pulled down, as just described, but the room will probably need to be flushed with air more frequently than is necessary when a better adjusted inlet and outlet can be provided. To change the air in a room thoroughly without danger to the patient, put extra blankets over her, leaving only her face exposed. If the bed is near the window, place a screen between them and open the window. If the weather is too cold to permit

of opening the window of the sick-room, or if the disease from which the patient is suffering demands a very even temperature, open a window in an adjoining —if necessary well heated—room and leave the door between the two rooms ajar.

How the Fireplace Acts as a Ventilator.—The heat of the fire causes the air around it to expand and become lighter and consequently it rises through, and out of, the chimney, thus leaving a vacuum which the colder, and therefore more dense and heavy, air rushes in to fill. Even a large lamp placed in the fireplace will answer the purpose, and as it will cause less dirt and work than a coal fire, it is a very good thing to use in a sick-room.

Prevention of Air Contamination by Defective Sewage and Gas Pipes.—As previously stated, leaking sewage and gas pipes are occasional causes of air vitiation. It is particularly important to obviate this source of air contamination in hospitals where there are so many other ways for the air to become impure. Nurses should therefore quickly detect any sign of leakage and report it. The return of gas through a sewer pipe is often due to blocking of the pipe and the stoppage is frequently the result of dropping some insoluble substance—as instruments—into a toilet or hopper. When such an accident occurs, if it is reported at once, the object can often be removed, but if the latter passes the trap, it will be washed into the pipes and may lodge where it will be difficult to reach, and even though not large enough in itself to cause stoppage in the pipes, it may, by preventing the passage of other solid or semi-solid substances, in time entail expensive repairs. Also, nurses must be constantly on the watch to see that the patients and

the help do not throw orange peel, pieces of gauze, etc., into the toilet.

CLEANLINESS.—Cleanliness is far from being the least of the requirements necessary to prevent air vitiation and in the hospital it is even more essential than in other places, and entails a greater number of matters to be considered. For example, even in warm weather, when all the windows are open, the air of the ward will have a fetid odor unless the patients are bathed and the bedclothing changed sufficiently frequently to insure perfect cleanliness. Bed-pans, douche-pans, and other utensils must be kept scrupulously clean and cared for as described in Chapter IV. Bed-pans must be kept enveloped in a heavy cover while carrying them from the ward, and should be deodorized after an offensive stool. When a patient is having unusually offensive stools, either as the result of disease or medication, an ounce or two of formalin put in the bedpan before giving it to her will lessen the odor very considerably. Sinks, hoppers, water-closets must be well flushed after use and kept scrupulously clean, and it requires constant watchfulness to make sure that this is done. Trash and garbage cans[1] and the receptacles for solid dressing must be kept covered and clean. Garbage cans should be emptied three times daily. The methods of cleaning will be considered in the next chapter.

TEMPERATURE.—The temperature of the ward or sick-room should be kept uniform. Except in the treatment of certain diseases, as pneumonia and tuberculosis, a temperature of about 68° F. is generally preferred in the daytime and of about 65° F. at

[1] Broken glass and crockery should never be thrown into the general trash or garbage cans.

night. In order that the temperature be properly regulated, it is necessary to have atmospheric thermometers. There should be one in every sick-room and three or four in a large ward in as many different places. Thermometers must not be hung near windows, registers, nor lights, and they must be, not only present, but frequently looked at. In order to prevent nurses forgetting this very important duty, the authorities of many hospitals provide charts or books on or in which they require the ward temperature to be charted every hour. Also, it is to be remembered that the ward temperature must not be only observed and charted, but, if it is either too hot or too cold, it must be regulated.

CHAPTER IV

CARE OF THE WARD, ITS FURNITURE AND UTENSILS

Necessity for Cleanliness. Nature and Action of the Agents Most Frequently Used as Detergents and for the Removal of Stains. Methods Used in Cleaning and Removing Stains from Walls, Floors, Furniture, Brass, Copper, Marble, Porcelain, Iron, and Linen.

BEFORE going into the details of the methods of cleaning we will consider briefly the nature of the methods and the nature and action of some of the materials most frequently used for the purpose.

Different Kinds of Actions that Enter into Cleaning

1. Solvent action, *i. e.*, the dissolving of substances by solvents; *e. g.*, water, alcohol, benzin, benzene, chloroform, ether, gasoline, turpentine.

2. Mechanical action, such as rubbing, sweeping, and the friction obtained by the use of rough substances, such as sapolio, bon ami, sand.

3. Chemical action. Many cleansing agents act by uniting chemically with the dirt or staining matter, thereby changing it into a soluble substance which can be easily removed. Of this nature are potash, soda, soaps, and the various substances used in bleaching, neutralizing, and reduction. Many of the soaps and soap powders have both chemical and mechanical properties.

4. Absorption. Some staining agents are removed by the use of such absorbing material as fuller's earth, talcum, starch, paper.

5. Extraction, *e. g.*, the removal of dirt by creating a vacuum in pipes or other apparatus, in consequence of which the dust and dirt are sucked into the latter.

Nature of the Solvents

Water.—Water is the solvent in most common use. The thing to be considered about water in regard to its cleansing properties is the amount and kind of mineral matter which it contains.

Hard and Soft Water.—Water which contains compounds of calcium and magnesium in solution is known as *hard water*, and water in which these compounds are not present is called *soft water*. The softness or hardness of water can be determined by the use of soap. Soap lathers readily in soft water, but in hard water it combines with the lime and magnesium to form an insoluble compound, and it is only after all the mineral matter in the water has become combined with soap that the latter will begin to form a lather or suds.

Temporary Hardness.—If the lime and magnesium compounds in the water are carbonates (*i. e.*, salts[1] formed by the union of carbonic acid and the

[1] Salts are formed by the chemical union of part of an acid and an alkali or similar substance. Salts are usually known by a contraction of the names of the acid and alkali of which they are composed and a prefix or affix, which shows the relative proportion of oxygen—O—which they contain; *e. g.*, sodium chloride, NaCl, is formed from the base soda and hydrochloric acid. As can be seen by the chemical formula, it contains no O, but every molecule of sodium hypochlorite, NaClO, contains one atom

alkali magnesium or lime, and known as *magnesium carbonates* and *calcium—lime—carbonate*), they will, when the water is boiled, lose some of their carbon dioxide[1] and will be thus changed from soluble acid carbonates, which can be held in solution in water, into an insoluble variety of carbonates, which, being insoluble, will be precipitated. The precipitate appears as a brownish fur on the bottom and sides of the boiler. After the carbonates have been precipitated the water is *soft*. When hardness can be thus easily gotten rid of it is spoken of as *temporary hardness*.

PERMANENT HARDNESS.—When the salts rendering water hard are not carbonates, but, for example, sulphates of magnesium and calcium, the hardness cannot be dispelled by boiling and such hardness has been called *permanent hardness*. The *hardness*, however, is not really permanent, for the water can be softened by the addition of sodium carbonate to the water; because this, by entering into combination with the salts in solution in the water, changes them from sulphates into insoluble carbonates which are precipitated.

Nature of the chemical reaction that occurs:

$$\begin{array}{ccccccc} \binom{\text{Calcium}}{\text{Sulphate}} & & \binom{\text{Sodium}}{\text{Carbonate}} & & \binom{\text{Calcium}}{\text{Carbonate}} & & \binom{\text{Sodium}}{\text{Sulphate}} \\ CaSO_4 & + & \text{Na Carbonate} & = & CaCO_3 & + & Na_2SO_4 \end{array}$$

USE OF SODA IN THE LAUNDRY.—As previously stated, a large amount of soap must be used in hard

of O; every molecule of sodium chlorite, $NaClO_2$, contains two atoms of O, and every molecule of sodium chlorate, $NaClO_3$, three atoms of O.

[1] Carbonic acid, H_2CO_3, consists of carbon dioxide, CO_2, plus water, H_2O.

water before any suds can be obtained, and as all soap used before a lather forms is useless, this entails a great waste of soap. For this reason, soda, which is much cheaper than soap, is put into the water first in order to soften it. If no more soda is used than required to soften the water, it will not harm the clothing, because by entering into combination with the salts in the water, it is precipitated and rendered harmless.

The amount of sodium carbonate necessary to use will depend, of course, upon the amount of lime and magnesium sulphates in the water. A very common average proportion of these salts in water is about 5 grains to the gallon. To precipitate this, it will require only about 3 grains of sodium carbonate to a gallon of water, or 1 pound of soda for 200 gallons of water, since every grain of soda used precipitates 1½ grains of calcium and magnesium sulphate. Whether this amount of soda is sufficient can be decided by the readiness of the soap to form a lather in the water. It will require about 2 pounds of soap to get the same result as 1 pound of soda carbonate.

Temperature of Water.—The temperature of the water used for cleansing is of importance. Hot water should be used for the removal of fat, but all dirt containing protein substances, as the albumin of milk, the nitrogenous substances in blood, feces and other excreta, should be washed off with cold or tepid water before the utensil or clothing is washed in hot water, for heat coagulates albumin and the coagulum is nearly always harder to remove than the uncoagulated substance.

Alcohol.—Ethyl, or grain, alcohol is usually made from carbohydrates by the process of fermentation

and distillation. Its chief use as a solvent for cleansing purposes is (1) to dissolve substances used as medicine, which have caused stains, the majority of such substances being soluble in alcohol; (2) to dissolve fat. Alcohol must be heated when used for the latter purpose. It is best heated by standing the utensil into which it has been poured in boiling water. It must not be heated directly over a flame as it is inflammable.

Benzin is a clear, volatile, inflammable liquid distilled from petroleum.

Benzene is a colorless, volatile, inflammable liquid derived from naphtha or soft coal.

Chloroform is a colorless, volatile liquid formed by the action of chlorinate of lime on methyl—wood—alcohol.

Ether—ethyl oxide—is a highly volatile and inflammable liquid obtained by the action of strong sulphuric acid upon alcohol.

Gasoline is a light volatile liquid distilled from petroleum. It is easily volatilized at a low temperature and the resulting vapor becomes explosive when it is mixed with a certain amount of air and warmed.

The chief value of these five liquids in cleansing lies in their solvent action on fats.

Turpentine is prepared from an oleo-resinous juice which exudes from incisions made in the bark of certain pine and fir trees. Its chief use as a solvent is for the removal of stains made with paint.

Nature of Mechanical Detergents

Whiting consists of fine chalk pulverized and freed from all impurities.

Bon ami is whiting made into cakes.

Silicon is a proprietary preparation that resembles whiting. It is more expensive than the latter, but is not really a more efficacious detergent.

Sapolio consists chiefly of sand and soap.

Nature and Action of Chemical Detergents

Potash.—This is one of the oldest of the cleansing agents. Early in the middle ages it was discovered that when plants and especially wood were burned, certain soluble salts were found in the ashes which, if boiled in pots with water, and the water allowed to evaporate, left a solid residue that had cleansing properties. This residue was named pot-ashes. Later it became known as potash, lye, and, in chemistry, as potassium carbonate (K_2CO_3). Some of the potash used to-day is made in the old way, but more is obtained from the refuse left in the making of beet-sugar, from the grease that is taken out of sheep's wool in the washing that precedes its being made into cloth, and from natural potash deposits, such as those which exist near Stassfurt, Prussia.

Carbonate of Soda (Washing Soda).—In the early days, wood was the only real source of obtaining potash, and as early as 1775 it was found that an adequate supply could not be obtained in this way. The Academy of Paris therefore offered a prize of 2500 *livres* for a method of converting sodium chloride —$NaCl$ (common salt)—into sodium carbonate— $NaCO_3$ (washing soda),—which it was known had the same properties as potassium carbonate. After many unsuccessful attempts, the problem was solved in 1791 by a Frenchman named Le Blanc. Space will

not permit of giving a description of the process here, but it can be found in any book of elementary chemistry. Soda carbonate soon became a much more plentiful and a cheaper article than potash and consequently rapidly superseded the latter in its use as a detergent.

Action of Potassium and Sodium Carbonate.—The detergent action of these two compounds is particularly valuable for the removal of fat, since they enter into combination with the latter, forming a soluble soap-like substance.

Soaps.—Soaps are made from fats and either caustic potash (potassium hydroxide) or caustic soda (sodium hydroxide). Caustic potash and soda are made by the action of caustic lime on solutions of potassium or sodium carbonate as follows: Burnt lime is slaked in water, and the milk of lime thus obtained is added to a solution of carbonate of potash or carbonate of soda. The lime unites with the carbonate, setting the potash or soda free to unite with OH,[1] and the carbonate of lime thus formed, being insoluble in water, settles down and caustic potash or caustic soda is found in the water. When either of these substances is boiled with fat, the latter separates into its component parts, namely fatty acids and glycerin, the fatty acids unite with the alkali (*i. e.*, the potash or soda) and, as always happens when an acid and an alkali unite, a salt is formed, the salt in this case being soap. Soap made in this way is in solution in the glycerin and water; therefore, salt is added, and this, uniting with the

[1] Nature of chemical reaction:

$$\overset{\left(\begin{array}{l}\text{Calcium}\\ \text{Hydroxide}\end{array}\right)}{COH} + \overset{\left(\begin{array}{l}\text{Sodium}\\ \text{Carbonate}\end{array}\right)}{NaCO_3} = \overset{\left(\begin{array}{l}\text{Calcium}\\ \text{Carbonate}\end{array}\right)}{CaCO_3} + \overset{\left(\begin{array}{l}\text{Sodium}\\ \text{Hydroxide}\end{array}\right)}{NaOH}$$

soap, makes it insoluble, and thus it is easily separated from the glycerin.

Types of Soap, Soap Powders, etc.—The differences in soaps depend principally upon the alkali and fat used in their manufacture. Soft soaps are made with potash and hard soap with soda. Fitted or loaded soaps are so made that they contain a large amount of water or other liquid and thus, though made with soda, they resemble soft soap. All kinds of fat are used for soaps, and fish oil, olive oil, cocoanut oil, castor oil, etc. Castile soaps are made with soda and either castor or olive oil. Olive oil soaps are made with olive oil and either potash or soda. The various patented preparations, such as Dutch cleanser, pearline, gold dust, etc., consist, for the most part, of soap, soda ash, and sodium carbonate.

How Soap Cleanses.—When, after rubbing soap upon our hands or other substances, we plunge them into water, some of the caustic soda and fatty acids separate and the freed alkali removes the oily matter on the skin or fabric, while the fatty acid and unchanged portion of the soap, with the help of the water, remove the dust and dirt mechanically.

Ammonia.—Ammonia gas—NH_3—is a common product of decay, being formed as the result of the putrefaction or oxidation of all protein substances, whether animal or vegetable, and it is derived from coal, as one of the by-products in the making of illuminating gas. This is, in fact, the chief commercial source of ammonia. It is an aqueous solution of the gas that is used as a detergent and neutralizing agent. The action of ammonia (NH_4OH) as a detergent is similar to that of the other alkalies potash and soda.

Nature and Action of Bleaches

Bleaching agents are used for the removal of stains. They consist of elements or compounds which will, by uniting chemically with the staining agent, cause its disintegration.

Oxygen as a Bleaching Agent.—Oxygen is one of the best and most generally used bleaching agents. It is obtained (1) by the use of such compounds as hydrogen peroxide, potassium permanganate, and various patented cleaning agents containing compounds which hold oxygen in such a loose combination that it is easily set free when it comes in contact with substances for which it has a greater chemical affinity. (2) Oxygen is obtained indirectly by the use of some substance that will free the oxygen contained in water. Chlorine is used for this purpose more frequently than any other substance.

Chlorine.—Chlorine is a gaseous element that enters into the formation of many compounds but is nowhere found free in nature. It is very frequently obtained from sodium chloride. Three chlorine bleaches in common use are (1) chlorinated lime made by passing nascent chlorine gas over unslaked lime; (2) Javelle water, a liquid containing chlorinated soda; (3) Labarraque's solution, an aqueous solution of several chlorine compounds of sodium, but chiefly sodium hypochlorite and sodium chloride. These substances all owe their bleaching action to the fact that when chlorine comes in contact with the water, it instantly seizes the hydrogen from the latter, setting the oxygen free. The oxygen then unites with, and disintegrates, the staining agent. Chlorine obtained in this way not only bleaches material, but

also rots it, unless, after having been subjected to the action of the chlorine, it is washed in some liquid that will neutralize the action of the latter. An aqueous solution of hyposulphite of soda is usually used for this purpose.

ACTION OF LEMON JUICE AND SODIUM CHLORIDE.—Lemon juice, sodium chloride, and water are frequently rubbed on stains to effect their removal. The way in which the stain is removed is as follows: The citric acid of the lemon unites with the sodium of the salt, setting free the chlorine. The chlorine then unites with the hydrogen of the water, setting free the oxygen, which unites with the substance causing the stain.

HYDROGEN PEROXIDE OR DIOXIDE.—Water is an oxide of hydrogen; it consists of two atoms of hydrogen and one of oxygen (H_2O). Hydrogen peroxide is H_2O_2. This is an unstable compound and breaks down easily into the water and oxygen.

POTASSIUM PERMANGANATE.—This is made by quite a complicated chemical process, from manganese dioxide, caustic potash, and carbon dioxide. The chemical formula is $KMnO_4$.[1] This shows that every molecule of potassium permanganate contains four atoms of oxygen and some of this oxygen readily leaves the potassium permanganate when it comes in contact with matter for which it has a greater affinity. To get good results, the potassium permanganate must be in solution. It should not be used on absorbent material as muslin or cloth. The stain that it makes can be removed with oxalic acid.

IODINE.—Iodine is frequently used to remove

[1] K is the chemical symbol for potassium.
Mn is the chemical symbol for manganese.
O is the chemical symbol for oxygen.

stains from non-absorbent material because it unites readily with many organic compounds and thus disintegrates them, which allows of their being easily removed. The stain made by the iodine can be taken off with alcohol or ammonia, as iodine is soluble in either of those liquids. Iodine is an element obtained chiefly from ashes of seaweeds. In its natural condition, it is a blue-black lustrous solid which crystallizes in shining leafy plates. It is solutions of this solid that are used for cleansing and medicinal purposes.

Neutralizing Agents

Stains due to acids can often be removed, and corrosion from the same cause can be stopped, by the use of an alkali as ammonia, potash, or soda, and *vice versa*. The reason for this is that when an acid and an alkali come in contact, they immediately unite and form a salt and water. This is called neutralizing, because the salt formed is usually neutral, *i. e.*, neither acid nor alkali or only slightly so. The neutralizing agents in common use are the alkalies ammonia, lime, potash, and soda, and the acids acetic and hydrochloric.

Acetic Acid.—This is made principally from wood by destructive distillation and purification; it can be obtained from alcohol, and it is present in vinegar, one of the best varieties of which is made by the fermentation of cider.

Hydrochloric Acid.—Hydrochloric acid, an unpurified form of which is known as *muriatic acid*, is made in several ways, one of the most common being by the action of sulphuric acid (H_2SO_4) on salt

(NaCl). Thus 2 atoms of NaCl added to 1 atom of H_2SO_4 makes 2 atoms of HCl (hydrochloric acid) and 1 atom of Na_2SO_4 (sodium sulphate). Thus:

$$2\ NaCl + H_2SO_4 = 2\ HCl + Na_2SO_4$$

Reduction

Stains on metals are very often due to oxygen—for instance, iron rust is an oxide of iron; that is to say, oxygen has united with the iron; likewise, black-looking stains that appear so readily on the copper sterilizers, etc., are due to oxygen, the oxygen in the air having united with the copper. To remove this, substances must be used that have a strong affinity for oxygen, such as petroleum, and oxalic acid. The taking of oxygen away from a substance is in chemistry spoken of as *reduction* and substances that will cause reduction are known as *reducers*.

Oxalic Acid.—Is a white solid which occurs in various combinations in many plants. It is made on a large scale by heating wood shavings or sawdust with caustic potash and caustic soda.

Petroleum.—The distilled product of a liquid pumped from wells driven into the earth in certain localities.

Absorbents

The only two absorbents that need be discussed are fuller's earth and talcum.

Fuller's Earth.—This is a kind of clay used by fullers (certain cloth workers) to absorb the oil or grease with which woolen cloth is sometimes treated in the manufacturing process.

Talcum, or Talc Powder.—This is prepared from a mineral that consists essentially of a hydrated silicate of magnesia.

Methods of Cleaning

Much of the ward cleaning is done by the ward helpers, but each nurse should know just how it is done and should of her own accord, if she is not required to, do enough of all kinds of cleaning to know how to do it, otherwise she will never be able to teach those under her.

Vacuum cleaners are by far the most sanitary forms of apparatus to use in cleaning hospital wards and rooms, because they remove the dirt by suction and do not scatter it. Unfortunately they are somewhat expensive, both to install and to operate, and are therefore not in very general use except in the newer and larger hospitals. When there is no vacuum cleaner the walls and floors must be dusted as follows:

The Walls.—The walls of a hospital ward should be brushed once a week. A long-handled soft brush covered with dampened cheese-cloth is generally used for this purpose. Always begin at the top and brush downward, taking care that every part of the wall space is swept. Chandeliers, window-edges, and all projections and cornices should be brushed at the same time. A dry duster should be used for the chandeliers.

The Floors.—The treatment of the floors depends upon the nature of their material. The dust should be removed, twice daily, from tiled floors with a brush covered with damp cheese-cloth, and they should be scrubbed with soap or soap powder and warm water

as often as necessary to secure perfect cleanliness. Deck scrubbers, *i. e.*, scrubbing brushes with long handles, are now much used for such work, and soap powder, such as Dutch cleanser. The latter is usually more economically used if it is kept in a shaker, like a large flour shaker, and shaken over the floor. Much should not be used, for to use more than is required is not only wasteful, but the extra amount is hard to remove and will give the floor a streaky appearance. It is well to scrub only a small portion of the floor before drying, and in scrubbing each new section to overlap the adjacent one already done. In corridors, or any place where there are many people passing, it is well to scrub one side first and then the other. During the scrubbing, the water must be changed frequently. *Dirty water will not make anything clean.* The floor can be dried with a mop.

Tiled corridor floors are occasionally mopped instead of scrubbed. In mopping, care should be taken not to use too much water, to change the water often, to wash only a small portion of the tile before drying it, to overlap the preceding section in washing a fresh section, and to press hard enough on the mop to remove dirt.

Hard-wood floors, which are more common in the hospital wards proper than tiled floors, are either paraffined or waxed, in order to improve their appearance, facilitate their cleaning, and to make them impervious to germs. The following preparation of paraffin is frequently used: Paraffin, 12 oz., turpentine, 2 gals., soft soap, 8 oz. The paraffin is first dissolved in the turpentine, the soap is added, and the whole is then allowed to stand for twenty-four hours. The floor should be either mopped or scrubbed

before this mixture is applied. It is applied either with a cloth fastened in a mop handle or a brush and after its application the floor is well polished with a weighted brush. This process should be repeated every two weeks. When wax is used, it is dissolved in turpentine, using about one part wax and two of turpentine; it is applied in the same manner as the paraffin. Floors treated in this way are kept clean by dusting them twice daily. Ordinary dry sweeping is not permitted in a hospital, for it scatters the dust. The usual way of dusting a floor is to cover a soft floor brush with a dampened, unbleached muslin duster. When dusting the floor, begin in the corners and work toward the center of the ward; follow the direction in which the boards are laid—do not sweep across the boards,—move the brush away from, and not toward, yourself; make firm pressure on the brush, change the duster sufficiently often to keep it clean—it will require at least six dusters for the floor of a large ward. The appearance of the floor will be much improved by polishing it vigorously every morning, after dusting, with a brush tightly covered with a flannel or canton flannel bag. The dusters and bag should be thoroughly washed after use and hung to dry in the place provided for them. Dust must be removed from the brush before putting it away; this is usually done with a metal comb, kept for the purpose. Brushes and brooms will wear better, and be kept cleaner, if they are stood brush end upward, or else hung up so that they do not touch the floor.

Water spots waxed and paraffined floors, therefore a small amount of the preparation used should be always kept in the wards and a little rubbed over places where water is splashed or spilled.

Care of Furniture and Utensils

Iron and glass, owing to their non-absorbency, and the comparative ease with which they can be cleansed, are much used for hospital furniture.

Dusting and Cleaning.—Special points to remember: (1) All the furniture in the ward, its pantries, rooms, etc., must be dusted daily. (2) Dust with a damp, not wet, duster, except gas and electric light fixtures and highly polished wood, such as is sometimes used in private rooms. (3) Have a basin of water at hand in which to wash your duster as required. The duster must be always clean. (4) When dusting, do not move the duster back and forth; this is waste of time, take one firm stroke. (5) Pay special attention to crevices, knobs, and bars, particularly those which are not seen. A splinter off a wooden tongue depressor is an excellent thing to use to remove dust from crevices. (6) Bon ami is about the best thing to use to remove dirt marks from white furniture; alkalies as soda, ammonia, etc., and soap soften paint, and in time they turn white paint yellow. Sapolio is so rough that it may cause scratches. (7) If dusting is done thoroughly every day, there will be seldom any dirty marks, and hard scrubbing and consequent removal of paint will not be necessary. (8) Whiting is the best thing to use for cleaning the glass of dressing carriages, medicine and instrument cases, and the like; alkalies gradually remove the polish of the glass. To clean with whiting, mix with cold water just enough of the powder to produce a thick cream, rub this sparingly over the surface to be cleaned, let it dry, then wash off the dried powder thoroughly with warm water, using a clean duster. (9) After use, dusters must be

washed until clean with soap and water and then hung in the place provided for them.

Care of Varnished Furniture.—It being necessary in the hospital ward to dust even varnished and oiled furniture with a damp (not wet) duster, measures must be taken to counteract the effect of the moisture upon the varnish. This can be done by wiping immediately with a dry duster and by the weekly application of a mixture of equal parts of oil and turpentine. This emulsion must be applied sparingly, however, and the furniture rubbed until all greasiness has disappeared.

To Remove Stains from Wood.—To remove white stains from colored wood, rub the stain well with tincture of camphor, equal parts of oil and turpentine, or oil and alcohol. Stains made by heat can sometimes be removed by the application of camphor. If alcohol is spilled on varnished or painted wood, pour oil over it immediately, before wiping up the alcohol. Grease stains on varnished wood are most easily removed by rubbing the spots gently with warm water and castile soap, drying the wood carefully, and afterward rubbing it with furniture polish or oil and turpentine, as previously directed. Grease stains on unvarnished wood are best removed by the use of strong alkalies—such as potash or soda—dissolved in ice-cold water. Wash off the alkali, after the removal of the grease, with hot water. To remove ink stains from wood, cover the spots immediately with some absorbent substance—such as starch, flour, or shredded blotting paper. After a few minutes, remove the application and apply another of the same sort. Continue to do this until the absorbent no longer becomes stained. Then rub the spots with

lemon-pulp and common salt until they disappear. Wash the wood afterward with cold or tepid water.

Cleaning Brass, Copper, and Nickel.—The sterilizers, hot-water cans, faucets, etc., are generally made of copper or brass, and, owing to their constant use, require frequent cleaning. There are various pastes, excellent for this purpose, on the market, but they are expensive, and oxalic acid and alcohol or oxalic acid and ammonia are frequently used in their stead. These mixtures clean well, but, in time, cause the metal to deteriorate, therefore it is well to add some kerosene to them. The kerosene, by neutralizing the acid, greatly lessens its bad effect and also furthers the cleaning process. A very effective polish can be made by dissolving two ounces of oxalic acid and about an ounce of whiting or one box of silicon in four ounces of alcohol, and adding to this solution one pint of kerosene. To use this polish, wash the metal to be cleaned with hot pearline water, wipe it well, and rub a little of the polish energetically over its surface with a piece of soft flannel. When all marks have been removed, burnish the metal by rubbing it with a piece of clean flannel or canton flannel.

To Clean Nickel and Silver.—To clean nickel, silicon or whiting is generally sufficient, but if the stains are very bad, a little alcohol or dilute ammonia may be added. Neither alcohol nor ammonia should be used frequently, however, as excessive use of these things destroys the nickel. Silver can be cleaned in the same way. Small silver articles such as knives, forks, etc., are now often cleaned by boiling them in a solution consisting of one tablespoonful of salt and one tablespoonful of baking soda to each quart of water

in a patented invention known as a *silver-clean-pan.* After they have been boiled for three minutes, the articles are removed, rinsed in clear water, and dried with a soft cloth.

TO CLEAN ALUMINUM.—Wash with hot water and either soap, bon ami, whiting, or very dilute ammonia water. Acids and strong alkalies must never be used because they decompose aluminum. To remove stains made by bichloride, iodine, and the like, there are two patented preparations that are very efficacious; one is called *Putz Pomade*, the other the *Universal Metal Polisher.*

TO CLEAN ENAMEL IRONWARE.—Wash with soap and water. To remove stains, boil in soda water, or rub the stains with dilute chlorinated soda or with Labarraque's solution.

TO REMOVE RUST FROM IRON OR STEEL.—Rub the metal with petroleum or oil. If the rust is not removed, keep the metal wet for several hours with one or other of the above liquids and then repeat the rubbing.

TO CLEAN PORCELAIN SINKS, TUBS, ETC.—For the daily cleaning of these things warm water and soap, soap powders, or bon ami suffice. To remove stains, rub the spots with either kerosene or tincture of iodine; to remove the iodine stain, rub with alcohol. Never use sapolio, oxalic acid, or strong alkalies for cleaning porcelain utensils. They are effective cleaners, but they gradually remove the polish and roughen the surface of the tubs and sinks, and thus make it very difficult to keep them clean. Sinks that are much used, however, should have a solution of hot soda water poured down their pipes daily, in order to prevent the collection of grease.

Care of Marble.—Acids destroy the polish of marble; therefore, if any acid, even orange or lemon juice, be spilled on marble, its action must be immediately neutralized by the addition of an alkali, such as ammonia or soda water. It is very difficult to remove stains from marble, but fairly strong solutions of alkali may be tried with safety, and will often produce the desired effect. Stains made by oil, or other greasy substance, should be washed with a hot solution of soda water and a paste made of fuller's earth applied. This should be left on for twenty-four hours. It is often necessary to repeat the application several times before it is effectual.

Care of the Refrigerator.—The inside of the refrigerator should be wiped with a damp cloth, daily, and twice a week everything should be removed and the whole interior thoroughly scrubbed with warm water and soap, if it is porcelain lined, or with soda and water if metal lined. Soda water should be poured down the drain pipe at least twice a week.

Important points that may be mentioned in regard to the refrigerator are: Its doors must be always kept closed; milk cans must be kept covered, and nothing sour or odorous is to be kept in the refrigerator. Anything spilled must be wiped up at once.

Care of Utensil Sterilizers.—The outside of the sterilizers must be polished sufficiently often to keep them bright; the inside must be thoroughly scrubbed once daily with soda water and sapolio.

Care of Utensils.—After use, bed-pans, sputum cups, and emesis basins should be rinsed first in cold water and then in hot water. The cold water is used because, as previously stated, hot water coagulates the albumin contained in excreta and makes it adher-

ent to the vessels; a thorough rinsing in hot water is necessary to prevent utensils becoming odorous, and to dry them. Never replace a bed-pan, etc., on the shelf or rack without seeing that it is perfectly clean. If there are any adherent particles, remove them with the brush kept for the purpose. Once a day all such utensils should be sterilized, by boiling, if possible, if not, by standing them in a disinfectant solution such as formalin, 2 per cent., or carbolic 1:40. Utensils used for patients suffering with an infectious disease should be sterilized after use and kept separate from those used for other patients.

Nature and Care of Hospital Beds and Bedding

Beds.—The beds used in nearly all hospitals are made of iron, painted and enameled, usually white, and provided with a wire spring. They average from twenty-four to twenty-six inches in height, six feet and six inches in length, and thirty-six inches in width. A three-quarters bed is often used in private rooms, but never a double bed. It would be impossible to provide a double bed with sheets sufficiently wide to be tucked in far enough under the mattress to prevent wrinkles. Besides, all moving and lifting would be rendered much more difficult for both patient and nurse.

The beds should be dusted daily as previously described, and on the discharge or death of a patient, the springs should be whisked and the bedstead washed with hot water and bon ami.

Mattresses.—Strong blue-and-white ticking is the best covering for mattresses, as fancy colors are apt to run when the mattress is disinfected. Ostermoor felt and good horse-hair are the best fillings. They

are more expensive than other varieties, but they wear so much better that they are cheaper in the end.

Air and Water Mattresses.—When patients come to the hospital with bed-sores, or when, for any reason (such as extreme emaciation or general anemia), there is more than usual danger of their developing such sores, it is often well to use air or water mattresses. These are made of rubber covered with ticking or canvas. To fit a bed with an air mattress cover the springs with a fracture board[1] and place the air mattress upon that, then blow the air mattress to the required stiffness with an ordinary force pump. There must be sufficient air in it to keep the patient from the board beneath, but not enough to cause pressure or to give the sensation of rolling.

Since the invention of the air mattress, the water mattress has not been as much used as formerly, because it is much the harder of the two to manage. It can be filled only after it is in place on the bed. When possible, the filling is done by means of a hose attached to a faucet; when not, the water has to be brought to the bed in pitchers and poured in through a funnel. The water should be 100° F.

If the patient is restless or unconscious, there is considerable danger of his falling out of bed when either of these mattresses is used; therefore, under such circumstance, side boards should be put on the bed; see Chapter V. Even when the patient is conscious, the boards should be used at night.

[1] The fracture board should be the size of the springs, and there must be several perforations in it for the admission of air. It is so-called because it is used under the mattress in certain fractures to guard against any disconnection of the points of fracture, by the sagging of the mattress.

Care of Mattresses.—All good mattresses are very expensive, therefore they must be properly protected. Defective rubber protectors are the most common cause of ruining ordinary mattresses, and sticking pins into air and water mattresses is the most frequent cause of the ruin of these two varieties. Therefore, form the habit of inspecting rubber sheets before putting them on beds—even a small hole may result in the ruin of the mattress—and to avoid ruining air mattresses, do not stick the pins you take from patients' binders, etc., into any kind of a mattress.

After the death or discharge of a patient who had an infectious disease, the mattress must be disinfected. Surface disinfection can be accomplished by exposure to formaldehyd fumes, but exposure to steam under pressure is necessary, if thorough disinfection is required.

After the discharge of a patient who has had an infectious disease, the mattress should be thoroughly brushed with a whisk moistened in water. While doing so, make careful inspection for bed-bugs. When these are present, they are more likely to be found under the tufting and binding. Signs of bed-bugs are small black spots or blood spots on the bedding. Exposure of the mattress to sulphur fumes is the most effectual treatment. If the mattress is whisked on the bed, the floor must be protected with a rubber sheet or it may be spattered with water.

The Pillows.—Feathers and horse-hair are the best fillings for pillows for hospital use. Usually every bed is provided with a feather and a hair pillow, the feather one being the upper, except when the patient is suffering from high fever or profuse perspiration. In the former case, only one is allowed

generally, and the hair, being cooler, is usually preferred. When there is profuse perspiration, or other conditions exist likely to cause the wetting or soiling of the pillow, a rubber pillow-case should be put on under the muslin one. After the discharge of a patient, the pillows are treated in the same way as the mattress.

Rubber Sheets.—In the hospital, the mattresses are nearly always protected with a rubber. The black rubber blankets used by the United States Army were formerly considered the best material for this purpose, but rubber sheets, similarly fashioned, but of softer rubber, can now be obtained and they are infinitely better. White double-faced rubber is very nice for home use, but the frequent disinfection required in the hospital discolors it so soon that its use for this purpose is not advisable.

When it is impossible to obtain rubber, oil-cloth, such as kitchen table covers are made of, may be used and, in an emergency, several thicknesses of newspaper, brown paper, or Japanese paper, tacked together.

Care and Cleansing of Rubber Sheets and Utensils.—Heat, acids, and fats destroy rubber, therefore rubber sheets are best cleaned by scrubbing them with warm—not hot—water and bon ami. Immersing them in formalin 2 per cent. or exposing them to formaldehyd fumes are about the best methods of disinfecting them. This is true also of rubber air-rings, cushions, etc. When not in use, rubber sheets should be kept either hanging or else rolled on smooth wooden rollers; they should not be folded, for this cracks the rubber. Rubber utensils, such as cushions, ice-caps, etc., must be thoroughly dried before they

are put away after use and slightly inflated with air, and it is well to put a small gauze pad in rubber ice-caps. Rubber goods that are not in constant use will keep better if stored in talcum powder.

Blankets.—Blankets bought for hospital use are usually about two parts cotton and one part wool. A much larger proportion of wool will not stand the frequent washings necessary, and blankets with a smaller proportion will not give sufficient warmth nor wear well. Care should be taken to prevent the unnecessary soiling of blankets, as washing greatly deteriorates them, and though dry cleaning is less harmful to the blankets, it is expensive. In order that the blankets may not be unnecessarily soiled or otherwise ruined, it is essential to remember the following points: Never allow the ends of a blanket to drag on the floor, and see that while it is over the patient, the top is well protected by the sheet and spread; use an old blanket when one is needed next the patient, and when there is likelihood of its becoming soiled in any way; do not use the bed blankets for baths and like treatments. In many hospitals, special blankets are provided for such purposes; these usually have less wool than other blankets and therefore do not shrink so readily.

Blankets are usually disinfected by exposure to formaldehyd fumes. They must be subjected to the fumes for twelve hours, because large quantities of the formaldehyd are lost by uniting chemically with the organic matter of the wool, which also hinders its penetration.

Sheets and Pillow Cases.—Sheets and pillow cases for hospital use are, in this country, always made of cotton. Sheets are about a yard longer and a yard

and a half wider than the mattresses. Pillow cases are usually about a quarter of a yard longer and an eighth of a yard wider than the pillows, because, when large they wear better and can be changed quickly.

Spreads for hospital beds are always made of light-weight material, thick spreads being uncomfortable and heavy for the patient and hard to clean. When doing private nursing, it is usually better to use a sheet if a light-weight spread cannot be obtained.

When sheets and pillow cases and spreads are removed from the bed of a patient suffering with an infectious disease, they should be put at once into the receptacle provided for the purpose, never on chairs and tables. The usual methods of treating such clothing in hospitals are: (1) to have a weak disinfectant in the receptacle (formaldehyd 2 per cent. is often used) and to keep the clothes in this until they can be taken to the laundry where they are boiled or exposed to live steam; (2) to have a heavy canvas bag suspended in an iron framework, which can be wheeled into the ward, into which the clothes are put. The bag can be tightly closed and taken from the framework for transportation to the laundry and the clothing emptied from it without any handling. All clothing soiled with excreta should be put into a disinfectant before handling.

Method of Removing Stains from Linen, etc.

A very important item in the care of the ward linen is the keeping it free from marks and stains. All stains should be removed before the articles are sent to the laundry. If they are put into cold or

tepid water while the staining agent is still wet, it can usually be washed out without much difficulty.

Bichloride Stains.—To remove bichloride stains, soak the stained linen in Labarraque's solution, one-quarter per cent. for twelve hours. Then soak and wash it thoroughly in hot water, for unless the soda is entirely removed the material will be destroyed.

Blood Stains.—If blood cannot be washed out with soap and tepid water, soak the stain in peroxide of hydrogen.

Coffee, Tea, and Fruit Stains.—Coffee, tea, and fruit stains can usually be removed by soaking in boiling water. If this fails, spread the spot over a bowl of boiling water and rub it with a solution of oxalic acid. Rinse afterwards with, first, ammonia water and then clear water. Another method is to immerse the stained portion in equal parts of boiling water and Javelle water, and, after a few minutes, wash it thoroughly in boiling water.

Glue Stains.—Apply vinegar to the spot with a piece of soft white muslin until the stain is removed.

Grass Stains.—Wash in either fels naphtha soap and warm water, ammonia and water, or alcohol. If none of these is effectual, spread a paste made of soap and bicarbonate of soda over the stain and allow it to remain for several hours; then wash it off in warm water.

Grease Stains.—Wash in either hot water and soap, hot soda water, hot alcohol, benzene, carbona, ether, or gasoline.

Ink Stains.—Stylographic and red ink stains can generally be removed by washing with soap and tepid water, especially if the washing is done while the ink is still wet. Stains made with other inks are best

washed with lemon juice, salt and water. Oxalic acid can also be used, but it will remove the fabric, as well as the ink, unless it is washed off very carefully. To use lemon juice, soak the stained portion in warm water until thoroughly moistened, then rub the stains with salt moistened with lemon juice; cover the stains with salt and lemon juice and put the article where the sun will shine upon it. Keep the stain moist with water and lemon juice and covered with salt. It may be necessary to continue the treatment for two or three hours; then wash with warm water. To use oxalic: Rub the stain until it disappears, with a piece of soft muslin wet with a saturated solution of acid, then neutralize the action of the acid by rinsing the article thoroughly in weak ammonia water. Turpentine, also, will sometimes remove ink stains, and it can be used on colored materials where the acids cannot. To use turpentine, soak the stain therein, and then rub it gently.

Iodine Stains.—To remove iodine stains, wash with alcohol or ammonia and then rinse in tepid water.

Iron Rust.—To remove iron rust, spread the stained part over a bowl of boiling water, apply to it common salt, wet it with lemon juice, and then place it in the direct rays of the sun. Repeat the process until the stain becomes light yellow. Then wash it in weak ammonia water and afterwards in clear water.

Kerosene Stains.—Cover the stain with a thick layer of moist fuller's earth and let it remain for twenty-four hours.

Meat-Juice Stains.—Wash in cold water, and then in tepid water and soap suds, or soak in hydrogen peroxide.

Medicine.—Soak the stained portion in alcohol.

Mildew.—Soak the stains in lemon juice until thoroughly saturated and place the article in the direct sunlight. If this is not effectual, cover the stain with a paste made of one tablespoonful of powdered starch, one teaspoonful of salt, the juice of one lemon. Allow this to remain on the stain for twenty-four hours. Repeat the application if necessary.

Chemical Affinity and the Action of Sunlight.—Chemical affinity is the agency which causes substances to combine and which holds them together when combined. The elements forming some compounds have not a very strong affinity for each other and such compounds are easily broken apart by bringing the substance in contact with an element or elements for which the component parts of the compound have a stronger attraction. Compounds are easily broken apart also when by chemical or mechanical means they have been made to take in a greater quantity of any element than they can easily hold in combination; peroxide of hydrogen, as already stated, is of this nature. On the other hand, the elements composing some compounds have a more or less strong affinity for each other and can only be broken apart by such agents as light, heat, and electricity. Of course, no very stable compound would be used for the removal of stains, but it will be noticed in the preceding pages that in the use of some agents sunlight is required. Sunlight is, as stated in the chapter on ventilation, a powerful assistant in producing chemical reactions, many of those that are constantly occurring in nature being due to the heat and chemical rays present in sunlight—see pages 85 and 299.

Moreover, sunlight is in itself a powerful bleaching agent, for it can by itself dissociate many compounds, as is only too frequently demonstrated in the fading of colored fabrics.

CHAPTER V

BED-MAKING; LIFTING AND MOVING PATIENTS

How to Strip and Air a Bed. Important Items to Remember when Making Beds and Moving Patients: Methods of Making a Closed Bed, an Ether Bed, a Fracture Bed, a Bed with a Patient in it. Methods of Changing the Upper Sheet, Pillows, Nightgown, the Under Sheet. A Mattress: Methods of Turning a Mattress, of Moving a Patient from One Bed to Another, of Lifting a Patient up in Bed, of Preventing a Patient Slipping down in Bed, of Sitting a Patient up in Bed, of Getting a Patient up in a Chair.

NO matter how clean and tidy the ward may be, it will not look so unless the beds are well made, and a patient cannot be made comfortable in a loose, sagging, uneven bed, nor in one in which the upper covers are too tight. This matter of making the beds is, therefore, one of the first things to which nurses should give their attention.

How to Strip and Air a Bed

(1) If the spread is on the bed, remove it, fold it neatly and hang it where it will not get crushed. (2) Loosen the bedclothes. To do this, raise the side of the mattress with one hand and pull the clothes out with the other; do this all around the bed. (3) Remove the clothes, one at a time, taking hold of each article in the center, which will prevent the ends

dragging on the floor; place the article over the back of a chair. (4) Turn the mattress over, from top to bottom, and then let it rest on its ends to air.

N. B.—The mattress should not be turned from side to side, for, if it is, the same part of the mattress will again bear the heaviest part of the body, and the mattress will become dented sooner than it will if properly cared for. The bed should be allowed to *air* for at least twenty minutes.

Bed-Making

The exact method of making beds differs somewhat in different hospitals, but there are certain fundamental principles that are the same in all hospitals. These are:

(1) The clothes under the patient are to be so fixed that they will remain very tight. If they become wrinkled, the patient will be uncomfortable; also, wrinkles in the sheet under the patient are one of the causes of pressure sores. In order that the clothes remain smooth, they must be pulled tightly and the ends put as far under the mattress as possible. If the sides of the under sheets extend to the center of the bed, the patient's weight will help to keep the sheets tight. Another point to remember is that it will be impossible to prevent wrinkles unless the sheets are put on perfectly straight. If they are crooked, the material is, as it were, on the bias, and if the sheet becomes the least bit loosened after the patient gets into bed, it will wrinkle; moreover, when making a bed with a patient in it, unless the sheet is quite straight before passing it under her, it will be impossible to get it free from wrinkles by pulling,

since pulling will cause the biased material to wrinkle. The upper clothes, when the bed is not occupied, should be pulled tightly, but they must not be tucked as far under the mattress as the under ones, because, if they are, when the bed is opened, the under clothes will be pulled out with them. When the bed is occupied, the clothes over the patient are to be arranged neatly, but, if they are tucked in, they must not be stretched tightly, especially over the feet. In order to get the bedclothes tight, it is better when tucking them in on the second side, to begin in the center and to pull each part quite forcibly before passing it under the mattress, and to stretch and tuck in each article separately.

Method of Making a Closed Bed

Cover the mattress with a sheet, leaving about eighteen inches to tuck in at the top; tuck it in along the side on which you are standing, well under the mattress. Put on the rubber sheet; this should extend from under the pillow to below the place where the patient's knees will rest; tuck it in on the side at which you are standing. Put on the draw sheet,[1] and tuck it in. Go to the other side of the bed, stretch each of these articles tightly and tuck them in separately, beginning in the center and working first toward the foot, and then toward the head of the bed.

[1] The draw sheet is so called because it can be drawn from one side or other when it gets warm and a cool place thus provided for the patient to lie on. In some hospitals, special sheets are provided for the purpose; when this is not the case, the sheet should be put on with its length across the bed, as the width of the sheet is never sufficiently long to allow of the sheet being drawn back and forth as required.

Fold the top of the under sheet like an envelope, and tuck it under the mattress. Put on the top sheet in the same general manner as the bottom sheet, but with the hem wrong side up, in order that the right side may be uppermost when the sheet is turned down over the blankets. Allow the upper end of the sheet

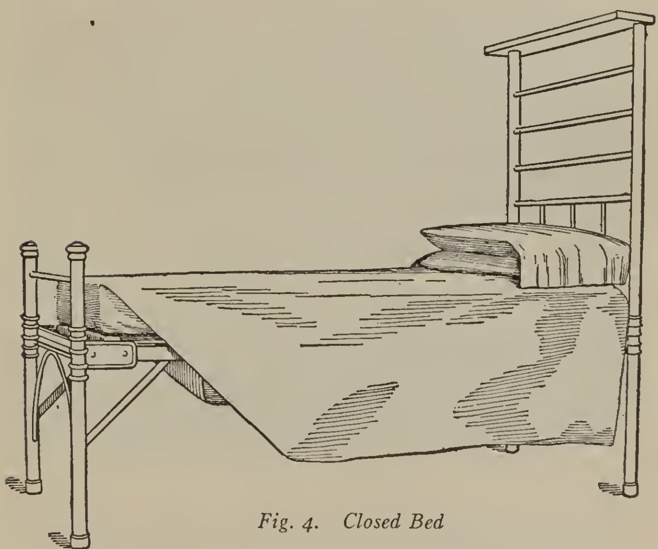

Fig. 4. Closed Bed

to come to the edge of the mattress, leaving sufficient to tuck in at the bottom, just as the under sheet was tucked in at the top. A closed bed may be made with one or two blankets, but it will always look better if two blankets are used. In the latter case, tuck the first blanket in on the sides only. At the bottom, fold it back under itself along the edge of the mattress. This blanket, like the sheets, should be pulled tightly before being tucked in, the good appearance of a bed depending largely upon its tautness. Fold the sides

of the second blanket under the body of the blanket, taking care that the edge of the fold is on a line with the edge of the mattress, and tuck it under the mattress at the bottom.[1] The top edge of the blankets should be about three inches from the top of the mattress. Place the upper edge of the spread on a line with the edge of the mattress, tuck it in at the bottom, fold the corners like an envelope, and tuck in the fold, allowing the sides to hang. (See Illustration.) Shake the pillows, press them on a table with the forearms until they are perfectly flat, and see that they are well into the corners of the pillow-cases. Then place them on the bed.

To Make an Ether Bed

Put on the lower sheets and the rubber as when making an ordinary bed. Tuck the upper sheet and blanket in at the bottom, but not at the sides, and fold them down to the foot of the bed. Lay a small rubber, covered with an ether slip or towel, on the place generally occupied by the pillows and tuck it under the mattress at the sides.[2] The only pillow used is one which is stood up at the head of the bed, to prevent the patient knocking her head against the bars, and which is kept in place by pinning the pillow-case over the bar. Place one hot-water can in the center of the bed and another near the foot. Put a clean nightgown over the cans and cover them and the bed with two folded blankets, one placed on

[1] Arranging the blankets in this way makes a sharp edge around the bed and helps to give it a neat, finished appearance.

[2] The head of the patient is kept low to reduce the work of the heart, and, by facilitating the flow of blood to the head, to diminish nausea, which anemia of the brain is likely to increase.

top of the other. Move the table and the chair, which usually stand beside the bed, to the back of the latter, to be out of the way of the stretcher, upon which the patient is brought to the bed. On the table, place a towel, two kidney basins, several small pieces of gauze for "mouth-wipes," and a mouth gag, or

Fig. 5. Ether Bed

tongue depressor[1]; the gag or depressor may be needed to put between the patient's teeth should they become clenched. As soon as the stretcher bearing the patient enters the ward, remove the blankets, folding them hot side inward, and remove the hot-water bottles. When the patient is laid on the bed[2] replace the blankets, covering her with the hot

[1] Gardeners' wooden labels make excellent depressors. They are not so liable to break the teeth as metal tongue depressors and mouth gags, and they can be thrown away after use.

[2] For manner of lifting the patient from the stretcher to the bed see page 510.

blankets, placing them hot side downward. To do this without exposing the patient, place one of the heated blankets, doubled as it was when on the bed, over the upper part of her body and the other over her legs, and, from the side, draw the blanket that is to be removed from under these. Put on the hot nightgown if the one the patient is wearing is at all damp. Tuck the blanket that is over the patient's chest under the mattress at the sides, and wrap the other around her legs.[1] Draw up the upper bedclothes and cover the part next the patient's face with a towel, putting one edge of the towel under the upper edge of the blanket that is across the patient's chest. In many hospitals, the hot-water bottles are not replaced in the bed, unless the patient is in poor condition or the ward or room is unavoidably cold. The reason for this is that while under the influence of an anesthetic patients are extremely easily burnt. The care of an ether patient is described in Chapter XX.

To Make a Fracture Bed

The only difference between a fracture bed and an ordinary bed is that a perforated board, the size of the wire mattress, is placed over the latter, in order to prevent any motion at the point of fracture by the sinking of the mattress.

Things to be Remembered in the Moving and Lifting of Patients

When making a bed with the patient in it, and in carrying out many of the other procedures described

[1] Arranged in this way the blankets serve to provide both warmth and restraint; also, stimulating or sedative enemata can be given if required, and hemorrhage watched for without exposing the patient.

in the following pages of this book, considerable moving and lifting of the patient are sometimes entailed, and there are certain important things to be remembered when moving or lifting helpless or weak patients, namely:

1. When a patient is very ill, especially when her heart-beat is rapid or weak, moving must be done without her assistance.

2. It is often important that very ill patients should be moved as little as possible.

3. When necessary to lift a patient's buttocks, as when passing a sheet under her or when giving her a bed-pan—unless she is too weak or has some injury of the legs—first, flex her knees and have her feet rest upon the bed. When in this position, she can help raise herself, and even if she is unable to do so, it is much easier to lift her if her thighs are raised, as they are, of course, when the knees are flexed.

4. When lifting a patient's shoulders, support her head. To do this, bend your arm slightly, pass it behind the patient, place your hand under her far shoulder, your fingers in her axilla, and let her neck rest in the bend of your elbow. When passing your arm behind the patient, raise her head with your free hand. (See Fig. 6.)

5. When moving a helpless patient to one side of the bed, pass one arm under her neck and shoulder and the other under the upper part of the thighs; draw her toward you or, if she is tall, put one arm back of her head and shoulders and the other under the small of her back, and move the upper part of the body first, then slip one arm under the small of the back and the other under the thighs and so move the lower portion of the body. When two nurses work

together, one supports the head and shoulders with one arm and slips her other arm under the small of the back. The second nurse slips one of her arms under the back also, right beside that of the first nurse, and her other arm under the thighs. Sometimes it is

Fig. 6. Lifting Head and Shoulders

better to stand on the same side, and sometimes on opposite sides, of the bed.

6. When moving a patient to one side of the bed, always draw her toward you.

7. Before attempting to lift a patient from the bed, draw her to the side of the bed so that you will not need to bend your back.

8. Avoid lifting a patient when your back is bent. Unless the bed is very low, bending the knees slightly will be, if the patient is at the side of the bed, all that is required to bring you to a proper level. If your

back is bent as you raise the patient, it will get much more of the weight than if it is straight.

To Turn a Patient on her Side

Method I. To turn a weak or helpless patient toward you, slip one arm over her far shoulder and obliquely across her back, so that your hand comes

Fig. 7. Turning a Patient

under her side; slip your other arm under her hips, also from the far side; raise her slightly, and, drawing her slightly backward, turn her toward you. It may be then necessary to move either her shoulders or hips somewhat. To move her shoulders, place your arms, one on either side, around her body, under her arm; raise her slightly and move her as required. Have the pillow under her head while doing this. To move the hips, grasp them in the same manner.

Method II. To turn a patient from you, slip one arm in under the patient's shoulders from the near

side, getting the hand as well around the far shoulder as possible. Pass the other arm under the hips, also from the near side, and have the hand come well around the far thigh. Raise the patient slightly, and pull her back toward you, turning her at the same time. It may be necessary to adjust her position as in Method I.

N. B.—When a patient who is very ill or weak is to remain on her side, she should be supported by pillows placed closely against her back.

To Make a Bed with a Patient in it

Order of Procedures:

1. Before starting to make a bed with a patient in it, be sure that everything necessary is at hand.

2. Loosen the bedclothes on all sides. As you draw out the clothes with one hand, raise the mattress with the other, to avoid jarring the patient and tearing the clothes.

3. Take off the spread, and if there are two blankets on the bed remove the upper one.

4. Change the top sheet, if necessary. When crushed, but not soiled, the top sheet may be used for the draw sheet.

5. Fold the sides of the lower blanket and top sheet up over the patient, leaving the fold just wide enough to cover her when she is turned. This answers a threefold purpose: it gives a neat appearance; the clothes are not in your way while you work; and it is as warm as though the upper blanket had not been removed.

6. Take the pillows out and shake them. If the patient does not object to being without them, leave them to air until the bed is made.

7. Change the nightgown if it is soiled; if not, brush all crumbs out of it.

8. Change the under sheets, if necessary; if not, tighten the under sheet and rubber and pull the draw sheet partly through, that the patient may have a fresh, cool spot to lie on.

9. Rub the patient's back with alcohol and afterward with powder.

10. Sweep all crumbs from the bed, either with the hand, a small whisk-broom, or a folded towel. Always use the hand, under the patient, since only with it will all crumbs and wrinkles be discovered.

11. Tuck in the top sheets and blankets, being careful to keep them loose at the bottom, over the patient's feet. If the weight of the bedclothes on the feet is uncomfortable, put a bed-cradle over the feet.

12. Put on the spread. Tuck it in at the foot, as when making a closed bed, but fold it back under the blankets at the top, and turn the upper edge of the sheet over it.

13. Replace and arrange the pillows so that the patient lies comfortably, every part of the body being supported.

These details should be carried out in the order in which they are given, since crumbs may be introduced into the bed by changing the nightgown, pillows, and upper bedclothes after the lower sheet.

Method of Changing the Upper Sheet

After loosening the bedclothes and removing the spread and blankets, place a clean sheet over the one that is to be removed, cover this with a blanket; if the patient is not too ill, have her hold these at the top.

If she is unable to do so, tuck them under her shoulders or under the pillow so that they will remain in place; then, standing near the foot of the bed, pass your hand under the clean sheet, take the sheet that is to be removed in the center, and draw it out. Never expose your patient while doing this.

To Change the Pillows

To remove the pillows, slip one arm under the patient's neck and far shoulder, letting her head rest on your arm, raise her slightly, and, with your free hand, remove the pillows, one at a time, pulling them outward. Before replacing the pillows, shake them and see that the corners of the pillows fit into those of their cases. To replace the pillows, put them within easy reach at the head of the bed, on the far side; raise the patient as when removing them; pass your free hand back of the patient, and draw the pillows into place. Do not allow an unconscious or helpless patient's head to be thrown forward on the chest, for such a position will interfere with her respiration.

To Change the Nightgown

Changing the nightgown is a comparatively easy performance in the hospital, as the nightgowns generally used there are short and open down the back. Remove one sleeve of the gown to be discarded, and put on the corresponding sleeve of the fresh one, by passing your hand through it, grasping the patient's hand, and drawing her arm through. Slip the fresh night-gown across the chest under the soiled gown (thus preventing exposure) and proceed with the second sleeve as with the first one.

When the gown to be removed is a closed one, have the patient lie on her back with her knees flexed. Pull the gown up as far as possible, then, if the patient is strong enough, have her raise her thighs slightly; if she is not sufficiently strong, place one of your hands under the buttocks and raise her while you draw the gown up with the other hand. Next, slip one arm under her neck and shoulder, raise her slightly, and draw the gown up around the neck; then slip one of your hands through the upper armhole of one of the sleeves, grasp her arm below the elbow and bend it slightly, while with the other hand you draw the sleeve off; slip the gown over the head and off the other arm.

The clean gown is put on in the same manner as the soiled one was removed, except that the order of things is reversed; thus, one arm is drawn into a sleeve, then the gown is put over the head, the other arm is drawn in its sleeve and the gown pulled down, raising the patient as when removing the gown.

Some important points to remember are: When a patient is weak or helpless, draw her arm into the sleeve of the gown by putting your hand in through the lower opening, grasping her hand, and drawing her arm through. If an arm is injured, remove the sleeve from that arm last, but put the sleeve of the clean gown on that arm first. When raising the patient's shoulders always support her head, as described on page 139. Be sure that the gown is well pulled down and free from creases.

Methods of Changing the Under Sheet

1. If the patient is fairly strong, the under sheet may be changed in the following manner. Either turn

her on her side, or draw her to the edge of the bed. Roll the under sheet as near the patient as possible; lay the fresh sheet, which has been either folded fan-shape, or rolled, next to this; tuck its free end as far under the mattress as possible. Be sure that the sheet is perfectly straight, and if it is rolled, that the roll faces the bed. Tuck in the rubber; treat the draw sheet in the same manner as the under sheet. Then, either turn or draw the patient on to the clean sheet. Take off the soiled sheets, stretch the fresh ones and the rubber tightly until they are absolutely free from wrinkles, and tuck them in separately and firmly under the mattress. It is, of course, not always necessary to change the under sheet.

2. When the patient is too ill to be either moved or turned, it is often easier to change the sheets by working from the top to the bottom of the bed. To do this, loosen the soiled sheet on all sides, draw it down to the nape of the neck of the patient, roll the fresh one, place it on the bed, and tuck its top edge under the mattress in order to keep it in place. Then, draw down both soiled and clean sheets together, slipping one hand under the patient and raising her as required.

3. When the patient is very ill, it is often well to have assistance in changing the sheet. In such case, stand one on either side of the bed, slip your arm nearest the head of the bed under the patient's head and shoulders, as when changing the pillows, and have your assistant pass her arm under the back. Raise the patient slightly; at the same time, each one with her free hand, pull first the soiled and then the clean sheet down as far as possible. Then lay the patient down, flex her knees, if possible, and pass your hand

and forearm under her back, while your assistant passes hers under the buttocks. Then pull the sheets down as before, raise the patient's feet, and pull the sheets to the foot of the bed. To remove all wrinkles from the sheet before tucking it in, you and your assistant stand and pull the sheet exactly opposite each other. If the sheet under the rubber sheet must be changed, the patient can be raised on the rubber and the sheets passed under it. In raising the rubber sheet, stand and hold the rubber sheet exactly opposite your assistant; hold the rubber sheet in your hand that is nearest the head of the bed and manipulate the sheets with the other. Do this before changing the draw sheet.

N. B.—Never fold or roll the clean sheet on the patient's bed. Let it rest on a table or chair while you are doing so.

Methods of Changing a Mattress with the Patient in Bed

There are several methods of doing this. Method No. I is to be preferred when the patient is very ill, but it needs at least three people and will require five or seven if the patient is heavy; also, it cannot be used if the bed has a high foot-piece.

Method I. Remove the spread and upper blanket, fold the spread neatly and hang it where it will not get crushed. Hang the blanket over the back of a chair, being careful that its ends do not touch the floor. Fold the sides of the upper sheet and remaining blanket back over the patient, turn the bottom part back under her legs. Remove the pillows and substitute a very small pillow or folded sheet. Loosen

the lower sheets, and bring the center of the upper portion of these around the patient's head like a cap (this will prevent the pillow falling out when the patient is lifted). Roll the sides as tightly as possible —roll side upward—until the rolls touch the patient on each side. Tie the bottom corners of the rolls together around the patient's feet and ankles (this prevents the clothes falling and getting in the way when the patient is lifted). Take hold of one roll close to the head and below the knees. Have an assistant do likewise on the other side. Lift the patient from the bed. The second assistant pulls out the mattress from the foot of the bed and shoves in the fresh mattress.

A hair mattress can be changed for an air mattress in this way. The fracture board, which it is necessary to have under the air mattress, is slipped under in the same way as the mattress, before the latter.

Method II. Proceed as in Method I as far as rolling the under sheets to the side of the patient; then, by pulling on one side of the rolled under sheet, draw the patient to your side of the mattress; next, have your assistant draw the mattress to her side, until half the wire mattress is exposed; cover the latter with the fresh mattress; draw the patient on to this; have the other mattress discarded. Go to the other side of the bed and with your assistant draw the fresh mattress into position; return to your side of the bed and draw the patient into place. If the under sheets are to be changed, before the patient is drawn into place, cover the vacant half of the mattress with the clean sheets, and with your assistant's help, both standing on the same side of the bed, lift the patient into position. Then remove the soiled linen and

draw the clean sheets over the remainder of the mattress.

Method III. When a patient is of light weight or able to move without much help, one nurse alone can easily change the mattress very much as described in Method II. A few points of difference are: (1) as the patient's movements must not be hampered, the upper bedclothes are not to be turned under her feet; (2) instead of rolling the under sheets, fold them as flat as possible, because when the patient is drawn to the side of the bed, she will lie on this fold; (3) a couple of heavy chairs or stools will be needed on either side the bed. Proceed as follows: (1) Draw the patient to the side of the bed on which you are standing; (2) go to the other side of the bed and draw the mattress until half the wire mattress is exposed; (3) place the chairs so that they will support the mattress, while you go round to place the fresh one on the bed; (4) draw the patient over, and place the chairs on this side in position to support the free end of the mattress; (5) return to the other side of the bed, remove the old mattress and draw the fresh one into place, and continue as in Method II.

Turning the Mattress

A mattress can be turned, instead of changed, in any of the three manners described. In Method I, after removing the mattress in the manner described, it is turned over, and the end that was formerly at the foot of the bed put at the head. In Methods II and III, after drawing the mattress to one side of the bed, cover the wire mattress with three pillows and draw the patient on to these. Then turn the mattress;

turn it from top to bottom, for the patient may fear that it will fall on her if it is turned from bottom to top. Continue as when changing a mattress.

To Move a Patient from One Bed to Another

Method I. This can be used for a convalescent patient. Remove the top covers except a sheet and blanket, loosen these at the bottom and sides; draw the patient to the side of the bed, move the second bed to this side, and arrange the sheet and blanket, covering the patient so that they will cover part of the second bed as well. If the patient needs assistance, lean across the second bed and draw her over, as when drawing her to the side of the bed.

Method II. Proceed as for Method I, but loosen the under bedclothes and draw the patient on to the new bed by making traction on the clothes. If the patient is heavy, it will be better, if possible, to have an assistant when doing this. In such case, both stand on the same side of the bed and pull at the same time, with equal force.

Method III. When the beds are of unequal height, or when they cannot be placed together, the patient will have to be carried and, unless she is light, one or two assistants will be needed. Wrap the patient in a sheet or blanket. Pass one arm under her head and shoulders, another under her back; have one assistant pass her arms under the back and buttocks, and the second pass hers under the thighs and legs; draw the patient to the side of the bed, ask her to hold herself as stiff as possible, straighten your backs, lift in unison, and carry her to the other bed.

N. B. Each one should know just what she is to do, and how she is to turn before lifting the patient.

Also, you must decide with which foot you will take the first step and start at the same time, but not with the same foot; *i. e.*, one steps with the right and the other with the left foot.

To Carry a Patient in the Sitting Position

If the patient is well enough to sit up, the easiest way to carry her is by making a chair with the hands. To do this, stand on opposite sides of the patient and raise her into a sitting position. Grasp your left wrist with your right hand, have your assistant do likewise, then grasp each other's right wrist with the left hand. The patient sits upon the seat thus formed and supports herself by putting her hand over your shoulders farthest from her.

To Lift a Patient up in Bed

Method I. Weak patients sometimes slip too far down in the bed and cannot return to their proper place without help. To give such assistance, flex the patient's knees, so that her feet will rest firmly upon the bed, and have her place her hands, palms downward on the bed; then pass your arm behind her, and supporting her head in the usual manner, grasp her under her far arm; put your other arm under her thighs, and, as she raises herself slightly, draw her upward.

Method II. Instead of having the patient place her hands on the bed, let her clasp them on your far shoulder, but have her arms cross your back and chest (see Fig. 10) so that an arm will not come at the back of your neck, since, if it does, the muscles of your back must bear the weight, otherwise your shoulder

will, which is much better. Place your arms and lift as in Method I.

Method III. If the patient is heavy or cannot help herself, it may require two nurses to move her. To do so, unless the bed is a wide one, it is usually better to stand on opposite sides. If possible, flex the patient's knees, even though she cannot help herself, as this makes her somewhat lighter; then grasp her under the far arm as when lifting her alone, and place your other arm under her back. Have your companion place one of her arms near yours and her other under the patient's thighs.

To Prevent a Patient Slipping down in Bed

Especially when the head of the bed is raised, it is often necessary to do something to prevent the patient slipping down in bed. Sometimes all that is required is to put a hard pillow between her feet and the foot of the bed. Some hospitals have a box-like arrangement which, with a pillow placed against it and held in position with a bandage, is used for the purpose, and in the home any kind of a wooden box of appropriate size will do equally well. Sometimes, especially in surgical nursing, it is important to keep the patient's knees flexed as well as to keep her from slipping down. One method of doing this is to double a pillow over a stout string or bandage, put the pillow under the patient's knees, pass the string, on either side, through wires of the wire mattress and the side bar of the bed on a line with this pillow. Tie it here and also at the head of the bed. Another method is to roll a pillow in a sheet, which is folded diagonally, place the pillow under the knees, and tie the corners

of the sheet to the head of the bed. A third method requires a special, though simple, form of support, which consists of two boards fastened at the top so that they form an angle the same shape as that existing between the under part of the thighs and legs when the knees are flexed. As can be seen in Fig. 8, in the center of the lower edge of the board which,

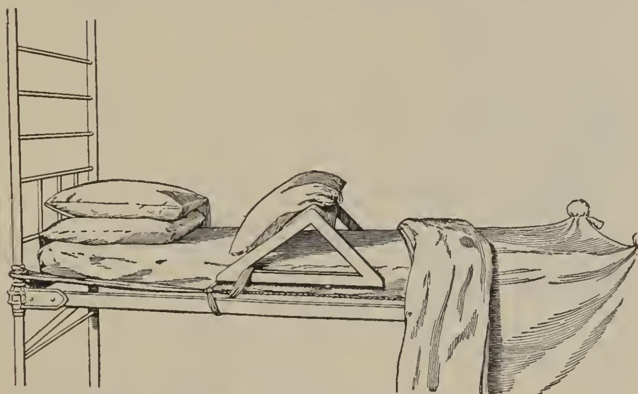

Fig. 8. Support for Knees

when the support is in place, comes next the body, there is an opening for the purpose of permitting the giving of the bed-pan without removing the support, and at each lower end of the same board, there is a hole through which a heavy string can be passed. This string is tied in the same way as when a pillow is used. A soft pillow or pad is put over the support before placing it under the patient's knees.

To Sit a Patient up in Bed

When a patient is fairly strong and able to move, she can generally be made quite comfortable when sitting

up in bed, by the use of a back-rest and a couple of pillows; but, if the patient is weak, or if her arms are edematous, it may require five pillows, even with a back-rest, to do so. For in such case, the patient's arms must be supported and pillows must fill the curves in the lower part of the back and the neck. The best method of arranging the pillows will depend upon

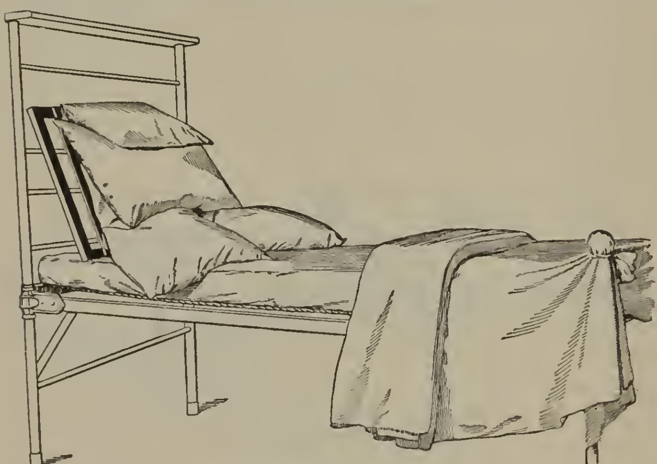

Fig. 9. Arrangement of Back-rest and Pillows

their size and shape. A method which answers very well with the long pillows commonly used in hospitals is to place a hair pillow upright against the back-rest, and a soft pillow on either side the patient, on the bed, slanting obliquely so that a corner of each pillow will fit into the hollow of the patient's back, and the body of each pillow afford a support for her arms; in front of the hair pillow, where it will come at the patient's back, place a soft pillow, and then, on top of this, a small pillow that will fit under the patient's neck and

support her head. If the back-rest is a canvas one, the hair pillow can be dispensed with, but with a wooden or metal rest, the hair pillow makes it easier to adjust the soft pillows and prevents their slipping.

The pillows cannot be adjusted until the patient is in a sitting position, and when the patient is sitting up for the first time after a severe illness, she may require to be supported while the pillows are being arranged. This being the case, proceed as follows: Have back-rest, pillows, and a nightingale where they can be easily reached and piled in the order in which they will be wanted. Draw the patient slightly higher in the bed, raise her into a sitting position, and support her by passing your arm, which is farthest from the head of the bed, in front of her chest. Place the nightingale across her shoulders, put the rest in position and then the pillows. Lay the patient back against the pillows, and make sure that she is comfortable. If necessary, take measures to prevent her slipping down in bed.

Patients who are troubled with dyspnea are often obliged to sit up continually, and often like to lean forward at times; in such case, place a small bed-table with a pillow on it in front of the patient. When a table is not to be had, a board with a block of wood nailed to either end, or even supported on magazines tied together firmly, will answer the purpose.

To Get a Patient up in a Chair

Preparation.—If the patient is not able to walk, and is at all heavy, the chair must be so placed that no unnecessary turns nor steps need be taken. Therefore, place it either parallel with, and a short distance—

two or three feet—from the bed, facing the head of the bed, or else at right angles with the bed. If it is near the head of the bed, let it face the bed; if near the foot, place the back of the chair against the bed. Make the chair comfortable by placing a pillow in the seat and another at the back. Over the pillows place a blanket cornerwise.

Fig. 10. Lifting Patient

The first time the patient is taken out of bed, she usually wears only a wrapper and stockings. The wrapper, if a closed one, is put on in the same way as a closed nightgown. If it is of kimono pattern, an easy manner of putting it on is to turn the patient on her side, place the kimono under her, turn her back upon it. Care must be taken to place the kimono in such position that when the patient is turned on her back she will lie on its back width and that its sleeves will be in place for her arms to slip in easily. Draw the patient's arms into the sleeves, fasten the kimono down the front—if it is loose, it may be in the way when she is lifted from the bed. This, and putting on the stockings, can all be done

under the bedclothes. Before putting on a stocking, turn the part of the stocking foot below the heel into the leg of the stocking. Slip the stocking foot over the patient's foot and then draw on the leg.

To lift the patient, fold the bedclothes down to the foot of the bed, draw the patient to the side of the bed, flex her knees, put one of your arms diagonally across her back so that your hand is in the axilla, pass your other arm under her thighs just above the knees, and have her clasp her hands upon your far shoulder, her arm coming across your back, as described on page 151. When she is in the chair, wrap the blanket around her in such a manner that it will remain in place, but not restrict her movements. If the chair has not a foot-rest, something that will act as such should be provided.

Count the pulse as soon as the patient is up and again shortly afterward. After an illness of any severity, a patient is seldom permitted to sit up longer than one hour, and a shorter time if she feels tired or her pulse becomes weak.

To Lift a Patient Back to Bed

Method I. Lift the patient as when taking her from the bed, but, as this will be much more difficult on account of the lowness of the chair, be careful to grasp her very securely and tell her to hold herself as stiff as possible before you lift her. If she is strong enough to place her feet upon the floor and give a slight upward movement as you lift her, it will be a great help.

Method II. If the patient is very heavy, it may require two to lift her. In this case, stand one on

either side of the chair, have the patient put one arm diagonally across each lifter's back and rest it firmly on her far shoulder. Place one of your arms across her shoulders and grasp her in the axilla; put your other arm under her thighs; have your assistant put one arm under the thigh and her other around the waist. Do not lift until both have a firm grasp and you have decided what turns it will be necessary to make. See that there is nothing in your way. It is generally easiest with a heavy patient to sit her on the side of the bed with her knees over the edge, and to lay her down and lift her legs into bed afterward and then draw her to the center of the bed.

Method III. Even when a patient is fairly strong, she may need some assistance in getting into a high hospital bed, unless there is a footstool at hand. When help is required, have the patient sit on the edge of the bed, place her hands on it, the one nearest the foot of the bed somewhat farther back than the other. Place your arms, one around her waist and one under her knees, tell her to raise herself slightly by pressing her hands on the bed as you raise and turn her on to the bed.

After the patient is in bed, draw up the bedcovers, take off the wrapper as you would a nightgown, take off her stockings by slipping your hand through the opening and drawing them down. See that the patient is in a comfortable position. Count and note the character of her pulse. After a patient has been up three or four times, or if she has not been very ill, it is not generally considered necessary to take the pulse.

CHAPTER VI

Care and Comfort of the Patient

Care of Patient on Admission. How to Undress a Patient. Care of the Patient's Clothes. Care of Valuables. Methods of Making Patients Comfortable. How to Give and Remove the Bed-Pan. Care of Patient's Mouth. Complications that will Follow Lack of Care of Mouth. Nature, Causes, and Means of Prevention, and Treatment of Bed-Sores. How to Rub a Patient's Back. Chafing—Nature, Causes, and Means of Prevention. Important Points to be Remembered in Connection with the Restraint of Patients. Restraining Devices and Means of Applying. Methods of Restraining a Child for Examination of Ear, Eye, Throat, and Chest. Preparation of Patient for the Night. Preparation of the Ward. Care of the Patient at Night. Means of Inducing Sleep. Night Nurse's Morning Work. Care of the Dead.

ENTERING the hospital for the first time as a patient is in many cases a trying ordeal, and a good warm reception will go far toward reassuring those who entertain the misapprehensions so prevalent concerning hospitals, and dispelling groundless prejudices and fears. It should never be forgotten that the care of a patient begins the moment she enters the ward, and great, indeed, must be the stress of work which will excuse a failure to give her immediate attention.

Care of Patient on Admission

Many hospitals are provided with a reception ward, where patients are undressed, and bathed,

except when they are in a very bad condition, before they are sent to the regular wards. In other hospitals they are taken to the regular wards immediately. If a newly arrived patient is very ill, she should be laid at once upon an opened bed which has been protected with an extra rubber and a bath blanket. If she walks to the ward, she must be given a chair, either in a room adjoining it, or just within its entrance. In the latter case, she should be placed far enough from the door to escape draughts, and to be out of the way of those passing. If the nurse in charge of the ward is busy, one of her assistants should come forward immediately and speak to the patient.

Even though an entering patient has been seen by the doctor before admission, she may have become suddenly worse. Therefore, if she seems in poor condition, notify the doctor. If the exterior of the body is cold, apply heat and extra blankets. In the majority of cases, the temperature, pulse, and respiration of a patient are taken as soon as she is admitted to the ward, and again in a couple of hours, after she has had time to rest and recover from the excitement incidental to her coming to the hospital.

Items to be Noted while Undressing a Patient

Unless the patient's condition counter-indicates, a bath is always given on admission. If her temperature is above 100° F., or below 98° F., her pulse weak or irregular, or if she gives any history of present bronchitis, pleurisy, influenza, or other lung disease, the bath must be given in bed. In the men's ward, the orderly usually undresses the patient; but if he is very ill, a nurse should assist. While undressing a patient,

note her general appearance; whether she is fat or thin; whether there is edema or recent loss of flesh[1]; whether she is poorly or well nourished, and whether there is any rash or any evidence of scratching. Note also any signs of discharge, wounds, ulcers, or even slight abrasions of the skin: any swellings, growths, loss of motion, or loss of any of the special senses. Report all abnormalities present to the nurse in charge; also any previous history volunteered by the patient.

To Undress a Patient

Unfasten hooks, buttons, and strings as far as possible. Remove skirts by, after flexing the patient's knees, if possible, slipping your hand and arm nearest the head of the bed under the patient's thighs, raising her slightly, and drawing the skirts down as far as necessary with the other hand; take them off over her feet. To remove the waist, take off one sleeve as directed on page 144, if the waist buttons in front, pass it back of the patient, and then remove the second sleeve. Remember, if one arm is injured, to take the sleeve from that last. Remove an underskirt as you would a nightgown. Sometimes, especially after accidents, to avoid moving the patient, it is necessary to cut the clothes. When this is unavoidable, cut in the seams and injure the material as little as possible.

Care of the Patient's Clothes

The exact detail of the methods of caring for the patient's clothes differ in various hospitals, but the principles are the same in all.

[1] This can be told by the loose, baggy, and wrinkled appearance of the skin.

Care of Valuables

Take everything out of the patient's pockets. Place all valuables and important papers—money, jewelry, receipts, pawn tickets, etc.,—in a package, writing on the wrapper the contents, the name of the ward, the patient's name, the nurse's name, and the date. Give this package immediately to the nurse in charge for transfer to the office.[1] The receipt for the package, which is generally given by the person who receives it in the office, should be kept by the head nurse until the patient is ready to leave the hospital.

Examination of Clothes for Pediculi

Examine the patient's clothes carefully for pediculi, remembering that, if they are present, they will probably be found under the seams and in the gathers. If any are found, or if the patient is suffering from an infectious disease, fold the clothes neatly and envelop in a protector,[2] which is wet with formaldehyd 2 per cent. or other disinfectant of equal strength. Enter a list of the clothes in the clothes' record, and add the patient's name, your name, and the date. Pin to the bundle, with a safety-pin, a tag inscribed with the name of the ward, the patient's name, your name, and the date, and transfer it immediately to the sterilizing room.

[1] The only valuables which ward patients are usually allowed to keep are wedding rings (if they desire to do so at their own risk) and a small amount of change; otherwise, loss, followed by unpleasant consequences, is likely to occur.

[2] In many hospitals, the patient's underclothes are tied up in squares of unbleached muslin. They are thus kept together and free from dust.

When the clothes do not need disinfection, fold the underclothes, shoes, and stockings in a protector. Include the hat if there be room for it, if not give it a separate cover. Dresses and coats should be hung, not folded. Each bundle, dress, etc., should be tagged as already described and put in the locker provided for the purpose, and the number of the locker entered in the clothes' record. If possible, send badly soiled clothes home by the patient's friends; if not, write the patient's name and the number of the ward on tapes, with indelible ink, sew the tapes firmly on the clothes, and send them to the laundry. It is a great unkindness on the part of nurses to mishandle or be careless about patients' clothes, as, no matter how old they may appear, they are probably of value to the owner.

Methods of Making Patients Comfortable

Making her charges comfortable is quite as important a part of a nurse's duty as giving them medicine or treatments of which they cannot reap the full benefit if they are disturbed by mental or bodily discomforts.

Means of Avoiding Mental Discomforts.—The influence of the mental condition on the body is not always sufficiently considered when caring for the sick. Anxiety and nervous irritation will often greatly retard a patient's recovery. If, for instance, a patient is worrying as to how the members of his family are to be provided for during his illness, the chances are that it will take longer for him to recover sufficiently to be able to provide for them. By remarking when patients seem worried and tactfully

ascertaining the cause of their trouble, you can often do much toward alleviating their distress. In all large cities there are institutions where help can be obtained for those in need, and the hospital authorities are always ready to apply to them for patients whose necessities are brought to their notice.

When nursing a patient in her home, you should endeavor, when it is necessary, to assume such household responsibilities as are a source of worry to the patient. You should be on the watch to tactfully exclude, or yourself entertain, tiresome or garrulous members of the family or friends. Above all things, you must endeavor to make your presence in the house a relief and not a burden. Friction with the servants is, perhaps, the most common source of trouble in "private nursing," and this could nearly always be avoided if, especially at first, you made it evident that you did not intend to give them any unnecessary extra work.

Little things, that a person would hardly notice if well, are apt to cause much mental and bodily irritation when ill. By remembering the following suggestions, you will shield patients from some of the more common causes of annoyance.

Some important items to remember are:

Never expose a patient more than necessary, when giving treatments, etc.

Always put screens around a bed in the ward before giving the patient a bed-pan, doing surgical dressings, giving baths, treatments, and so forth.

Before starting a treatment, tell the patient something of what you are to do, especially when you are to use some apparatus that may seem mysterious or alarming to the patient.

Notice when a light worries a patient or when she is in a draught.

Endeavor to remember a patient's likes and dislikes; especially in regard to her food.

Never take longer than absolutely necessary to fulfil a patient's request; especially when she has asked for a drink or the bed-pan.

Never whisper in or near the sick-room, or in a ward, near the bed of the patient about whom you are speaking—not even when she is apparently unconscious.

Never discuss a patient's condition with her or with any one else in her hearing, and, as far as possible, avoid telling a patient what medication she is getting, what her temperature is, and the rate of her pulse—even when they are normal. Great tact is often required in carrying out this last instruction because patients are often extremely irritated when a nurse refuses to give them all desired information regarding their treatment and condition.

Never lean or sit on a patient's bed, and be careful not to knock against it in passing.

Never rock in the sick-room.

Keep door and window hinges well oiled and never allow doors and windows to bang.

Bodily Comfort.—Some of the many devices that should be resorted to to relieve bodily discomfort are: (1) Massage—unless existing conditions make its use not advisable; rub the body, especially the back, with alcohol. (2) Pull the draw-sheet partially through, under the patient, so that she will have a cool place to lie on. (3) Change the position of the pillows as soon as they become disordered or uncomfortable. (4) Small pillows, hot-water bags, partially filled with warm water, or small pads, placed in

the hollow of the back, will often relieve local pain; a folded pillow tied firmly together, placed under the knees, will relax strain on the abdominal muscles. Many hospitals provide triangular pillows for this purpose—the base rests on the bed and the knees are supported on the rounded top. (5) Properly adjusted pillows will go a long way toward securing a patient's comfort, especially when she is lying on her side or sitting up. No exact rules for the arrangement of the pillows can be given beyond this,—when a patient is weak, every part of the under surface of the body wants to be supported, therefore, wherever it does not touch the bed a pillow or a pad will probably be acceptable. (6) Never forget that helpless patients, no matter how comfortably they may be fixed, often get very, very tired when they lie hour after hour in the same position, and that they may need to be turned or have their position changed in some way quite frequently. (7) In cases of rheumatism, neuritis, etc., pain is sometimes lessened if the affected parts are fixed by means of splints or sand-bags. When there is inflammation in an extremity; relief can often be given by elevating the affected part on pillows. (8) An extremity thus elevated must be supported its entire length and the elevation must be gradual. That relief is thus afforded is due to the fact that the pain is caused by pressure on the nerves from the dilated blood-vessels and the excess fluid which is present in the tissues, and when the extremity is raised, less blood is sent to the affected part, and the exudation of serum into the tissues is thus lessened.[1] (9) When a painful limb has to be moved, its entire

[1] Sometimes this condition is treated in exactly the opposite manner. This will be discussed on page 409.

length must be supported; thus, to move a leg put one hand around the foot and ankle and raise it slightly, slip the other forearm under the leg so that your hand is under the knee and the front of your elbow under the heel. (10) When the weight of the bedclothes causes discomfort to any part of the body, a bed-cradle should be used to support them. (11) When the patient is very thin, pressure on the bony protuberances must be relieved. This can be accomplished by binding on or laying under them air-rings or rings or pads made of cotton-batting or non-absorbent cotton and gauze.

To Give and Remove the Bed-Pan

If the pan is cold, it must be warmed before use. This is usually done most quickly by letting hot water run over it. Be sure that it is dry. Before giving the patient a pan, flex her knees, if possible, then pass one hand under the sacrum, raise her, and insert the pan. Raise her in the same manner before removing the pan. This is a very important point to remember, for, if you attempt to remove the pan without doing so, it may be jerked and some of the fluid contents spilled in the bed. As soon as it is taken out it should be covered, either with double-faced rubber or with a cover of thick washable material. After using the pan, the patient must be cleansed with toilet paper, and a very ill or a private patient should be, after the use of the paper, washed with warm water and dried. A couple of pieces of soft gauze can be used for this purpose, and these should, after use, be washed and kept for the same purpose and patient.

Never empty a bed-pan without noting its contents

and when necessary making careful examination. This will be further discussed in Chapter IX.

Care of Patient's Mouth

Convalescent patients should, twice a day, be given all that they require to brush their teeth. If a patient has not a tooth-brush, she must be given whatever the hospital provides as a substitute. In some hospitals this is a short piece of whalebone with a small piece of gauze to wrap around one end; in others, a wooden splinter—like a long tooth-pick—and gauze; in others, small pieces of gauze to wrap around their finger. When the patient is too ill to brush her teeth, the nurse must do it for her, and in such case, whalebone or similar substance with gauze wrapped around one end is by far the best thing to use, because the bone can be bent in all directions. To cleanse a patient's mouth, there will be required: (1) a glass with the mouth wash; (2) the whalebone, several small pieces of gauze or cotton to wrap around the end of the bone—after one use the gauze must not be redipped in the solution—a small basin for the used pledgets, and a kidney basin for the patient to discharge the solution into after rinsing her mouth. To cleanse the mouth, wrap a piece of gauze or cotton around the end of the bone, dip this in the mouth wash, wash every part of the mouth and tongue thoroughly, use as many pledgets as necessary, never dip one in the solution after it has been used. When the mouth is dry, it is well to apply a lubricant after the cleansing.

In some hospitals, on the bedside table of every fever patient, there is kept a small tray holding a covered glass containing mouth wash, a small oint-

ment jar with boric acid or cold cream, a small covered glass jar with pledgets, a small enamel saucer to receive the soiled pledgets, and a piece of whalebone. This saves time, when the patients' mouths are to be washed every two hours. The solution glass is washed and refilled twice in twelve hours and oftener if necessary. It is kept covered when not in use, and only clean pledgets dipped in it. Albolene and boric acid 2 per cent. with a little lemon juice are sometimes used, also boric acid ointment, and various cold creams. Glycerine should not be used when the mouth is dry, on account of its property of extracting fluid from the tissues. When the mouth is in bad condition, it is often necessary to wash it with hydrogen peroxide. This should be diluted to half its strength with water and the mouth rinsed and carefully washed afterward. If a patient has false teeth or a plate, they should be removed and carefully cleansed with tepid, not hot, mouth wash, or water and tooth-powder. If they are left out temporarily, they should be kept in cold water; if they are not to be put in for some time, they should be rolled up carefully and put where there will be no danger of their being lost or broken.

Condition of Fever Patient's Mouth.—When a person's temperature remains high for any length of time, the membrane of the mouth and the tongue become dry and cracked, and only the greatest care will prevent what is known as *sordes* collecting in these cracks. This sordes consists of milk, broth, or whatever food the patient gets, dried epithelium, and bacteria.

Necessary Care.—The mouth of a fever patient must be thoroughly cleansed after each feeding, in the manner just described, and if the fever is due to

bacterial invasion, as in typhoid, many physicians require that the mouth be washed also before feeding.

Complications that will Follow Lack of Care.—Lack of care, even after one or two feedings, will result in such a collection of sordes, that in endeavoring to remove it, the mouth may bleed. If this happens often, ulceration of the gums may follow; also the condition present will so favor the growth of bacteria that infection may travel through the Eustachian tubes to the ears and cause infection of the middle ear and even mastoiditis, or the salivary or lymph glands may become infected; tympanites will almost surely occur and, as will be seen later, this is often a very serious complication; also, in typhoid, reinfection of the patient has been often attributed to lack of care of the mouth.

Pressure Sores

Nature.—A pressure sore is gangrene or death of a portion of tissue due to defective nutrition of the part. The defective nutrition is usually the result of: (1) the patient's physical condition, (2) pressure on the affected part by the bed, splints, or other apparatus. Pressure sores due to contact with the bed are commonly known as bed-sores.

Most Common Locations for Bed-Sores.—The bony prominences, such as the back of the head, shoulder-blades, elbows, lower end of the spine, heels, the back of the ears, and the buttocks are the parts of the body on which bed-sores most often occur.

Predisposing Causes.—These are lowered vitality as in old age, or after a long illness, continued high fever, paralysis, extreme emaciation, general edema, excessive obesity.

Active Causes.—These are moisture in the bed, wrinkles in the nightgown or under sheets, crumbs, a too long continuance in one position, improperly protected splints or those too tightly applied.

Preventive Measures.—(1). Keep the bed dry. When a patient has involuntary micturition or bowel movements, put a large oakum pad, with a foundation of several thicknesses of newspaper, under her; if she is restless, bind the pad in place with a three-cornered piece of old muslin or gauze, putting the muslin or gauze on like a child's diaper. Change this immediately when it becomes soiled or wet. (2) Look for crumbs after every meal, and brush them out, as already directed. (3) Keep the draw sheet tight, to avoid wrinkles. (4) Bathe and rub the affected parts with alcohol and powder at least thrice in the twenty-four hours and more frequently when predisposing causes exist. (5) When the patient can be turned, frequent change of position will do much to prevent the forming of bed-sores; when not, the affected parts must be relieved from all pressure by the use of rings. If rubber rings are used, they should be inflated only just enough to keep the parts off the bed; because when too hard, they are very uncomfortable, and can be themselves the cause of bed-sores. They should either be put in a pillow-case or covered with bandages. Small rings to fit the back of the head, ears, elbows, heels, and ankles can be made by tying a piece of cotton-batting into a ring the required size, and winding it with a bandage. (6) When there is imminent danger of the breaking of the skin, the patient should be put on an air bed, and the affected parts should be washed gently with warm water and soap at least four times during the twenty-four hours,

and rubbed with alcohol and powder at least every three hours. A preparation of flexible collodion (equal parts of collodion and of castor-oil), painted over the surface, will sometimes prevent the skin from breaking, by forming a protective covering. The doctor should be notified when there is any indication that the skin is likely to break. If it does break, the resulting sore is often very hard to heal; and not only causes the patient unnecessary suffering, but may also retard her recovering. *Except in very rare instances, the nurses in charge of a patient are responsible if she develops a bed-sore.*

Treatment of Bed-Sores.—The treatment of a bed-sore is, of course, ordered by the doctor. Usually, it is treated like any other granulating wound, including the taking of aseptic precautions. Sometimes massage and the application of electricity to the surrounding parts are ordered for their effect on the circulation. In giving massage, pressure must be made toward the wound so that its edges will not be pulled apart.

To Wash the Back.—Use water about 105° F. and soap. If possible, turn the patient on her side; if she is weak, turn her toward you as you can then support her with one arm while you work. Turn back the upper corner of the bedclothes enough to have them out of your way, but not sufficient to expose the patient; protect the bed with a small rubber covered with a towel—the latter can be used also to dry the patient. Begin to wash at the neck.

How to Rub the Back.—If the patient is not already on her side, turn her as described in the preceding paragraph and proceed as follows: (1) Pour a little alcohol on one hand and rub it on the back.

(2) Beginning at the neck, place your hand firmly on the skin and, holding your hand still, move the flesh on the bone. Do this all over the back, spending extra time where the skin looks red. (3) Put some more alcohol over the back and rub until dry. (4) Pour some powder on your hand and rub it on the back. Do not use too much powder.

Chafing.—Akin to bed-sores is the irritation and breaking of the skin that may occur where two surfaces of the body rub against each other, as in stout people, under the breast, and in the groin. A baby's skin will become chafed very readily unless it is kept dry, and a horrible condition of the buttocks will very promptly follow failure to change the diapers when they are wet or soiled.

Preventive Measures.—Keep the irritated parts clean and dry. To prevent chafing in the conditions described, first, twice a day, wash the threatened parts with soap and hot water; dry carefully by patting, not rubbing; rub gently with alcohol and powder. It may be necessary to rub the parts with alcohol and to powder them frequently, especially in hot weather.

To prevent a baby's buttocks becoming chafed, change the diaper as soon as it becomes wet, and, especially after a defecation, clean the parts by washing gently with warm water and soap; dry thoroughly by patting gently with a hot towel; powder. Never use a diaper that has been wet with urine until it has been washed. If a baby's buttocks become chafed and you know that you have taken all preventive measures and there is nothing in the nature of the stools to cause chafing, find out how the diapers are being washed, irritation being sometimes due to the

use of diapers that have been washed in strong soda solutions.

The Restraint of Patients

Important Points to be Remembered.—There are a few things in connection with the restraint of patients that must never be forgotten.

(1) A patient is never to be restrained unless it is absolutely unavoidable.

(2) When restraint is employed, it must be effectual, but no matter how effectual you may consider it, the patient must be watched, for delirious and insane patients are often very strong temporarily and also very cunning in devising means to unfasten the restraining appliances.

(3) Restraint around the arms and legs must not be applied too tightly, or it will interfere with the circulation.

(4) Do not fasten the legs or arms in an uncomfortable position.

(5) Watch that restraint around the wrist and ankles does not become tightened when the patient struggles and that it does not abraid the skin.

(6) If possible to avoid it, do not apply restraint over the chest. It will interfere with the respiration, and if a strait-jacket is used, fasten it in such a way that sufficient space will be left over the chest for free respiratory movements.

(7) The pulse of delirious patients who are struggling or very restless must be felt frequently. For such patients often die very suddenly, the extra work thrown upon the heart by their struggles being more than that organ can stand. This is particularly true of pneumonia patients.

Restraining Appliances.—In many hospitals, some form of strait-jacket or camisole is kept for emergency. Such appliances are, however, little used now except for excessively violent patients. Every nurse in the hospital should, however, know how to manipulate the one that the hospital in which she is provides for such cases. Padded leather handcuffs and anklets, which can be adjusted to the wrists and ankles and strapped to the bed, are used occasionally. There are three important precautions to observe in using these, viz.: (1) Do not fasten them so that the buckles will be within reach of the patient, even if they lock. (2) If the lining of the cuffs is rough, place some soft cotton around the wrists and ankles under the cuffs. (3) Do not fasten the strap in such a way that the legs or arms will be uncomfortably pulled upon. These appliances, like camisoles, are not now used as much as formerly in general hospitals, less obvious restraining devices being preferred. Frequently it is not necessary to restrain the patient at all, but only to have side boards on the bed. These boards are usually about one inch thick, fourteen inches high, and the length of the bed. They have holes in the four corners by means of which they can be tied to the bars of the bed at the top and bottom, and they are usually painted the color of the beds. The spread can be so arranged that it will fall over them. Instead of, or in addition to, the boards, a folded sheet is sometimes placed across the thighs and fastened to the sides of the bed, or, instead of this, a piece of strong, but soft, canvas with eyelet holes on either side, which allow of the canvas being laced with stout cord to the side bar of the bed. The cord lacing should, on either side of the bed, be passed

around the top and bottom bar and this will keep the canvas from slipping up or down and from wrinkling.

N. B.—*Do not tie within reach of the patient! Do not allow this restraint to come over the abdomen of a typhoid patient.*

As a substitute for handcuffs and anklets, squares of gauze folded cornerwise or doubled strips of muslin, about 12 inches wide and 2½ or 3 yards long, machine stitched around the edges, are used. These are tied around each wrist and ankle in a *modifed clove hitch* and then to the side of the bed, and, in the case of the muslin, to the foot of, or under, the bed. When the muslin is used, much greater freedom of the patient's arms can be allowed, as the restraint is then tied beyond her reach.

To tie the clove hitch, proceed as follows: Make two loops forming the figure eight with both ends on top and going in opposite directions; put the loops together and pass them over the hand or foot as the case may be, drawing them just tight enough to prevent the hand or foot being slipped through; make a knot in the ends about twelve inches from the limb and tie them to the bedstead. Great care must be taken to follow these directions implicitly, for, when the clove hitch is improperly made, either it will not hold, or, worse still, it will tighten and shut off the circulation. If the patient is struggling very much, or if her skin is delicate, a thin piece of cotton-wadding should be wrapped around her wrists or ankles under the gauze or muslin. To keep the patient from sitting up, the following contrivance is sometimes used: A band of muslin, such as is used for the hands, or a sheet folded cornerwise, is placed under the shoulders, the ends brought up under the axilla, over the shoulders, and

FIG. 11.—CLOVE HITCH

under the band, at the back; they are then crossed under the pillow on which the patient is lying and tied to a bar at the head of the bed on, or below, a level with the mattress.

Restraint of Children

The Bradford Frame.—The Bradford frame is an appliance much used for restraining children, as well as for other purposes to be described later (page 497). It consists of a frame of gas piping about two inches in diameter, and nearly all hospitals in which children are treated are provided with several sizes.

To Apply.—Choose a size a few inches longer than the child and sufficiently wide not to come in contact with the shoulders. Place the child between the bars, cover the former with a small sheet, or, if after operation, an old blanket. Place a band of canvas across the child's body, from under the arms to the ankles, pass it under and then around the frame and lace it in front like a corset; tie the laces at the bottom out of reach of the child. Two canvas boards are sometimes used instead of one large one. If the child is very restless, the frame can be tied to the bed. When this restraint is used after operation, it should be put on before the child has recovered from the influence of the anesthetic, for if put on before he is conscious, he is less likely to notice it or object to its presence.

Restraint of a Child's Arms.—Various devices have been contrived to restrain a child's arms. Two very commonly used are: (1) Canvas sleeves and a yoke, with a large eyelet hole in the cuff of each sleeve through which a cord can be passed and tied to the foot of the bed. (2) A padded splint is bandaged on

the anterior surface of the child's arm in such a way that the elbow cannot be bent. This last method is very frequently used to prevent a child interfering with its dressing.

Restraint of Child for Examination of Ear.—Sit in front of the doctor, and place the child in your lap with its legs between yours. Cross one of your legs upon the other, thus imprisoning the child's legs. Hold the child's wrists with one hand, and with the other press its head against your chest, having the ear to be examined toward the doctor,

Restraint of Small Child for Examination of Eye.—Wrap the child's body in a sheet, sit facing the doctor, and place the baby on its back in your lap with its head on the doctor's knees.

Restraint for Examination of Throat.—Sit facing the doctor with the child on your lap and its legs between yours, as for examination of the ear. Pass one of your arms behind the child's arms—above the elbow—and back, grasping one arm firmly, but gently, with your hand; with your other hand, hold the child's head against your shoulder.

To Hold and Restrain a Small Child for Examination of Chest.—Some hospitals are provided with long narrow tables, the top of which can be raised and lowered with a lever. The child, when laid on this, can be easily held in any position required without frightening it or letting it feel restrained. When there is no table, a small child can usually be kept quiet more easily if it is held in the arms. To hold a baby for examination of the posterior chest, it is usually better to stand and hold it, with its chest across yours, one of your arms around its thighs, just under the buttocks, your other arm across its outer

FIG. 12.—METHOD OF RESTRAINING CHILD

shoulder, and your hand holding its head on your shoulder.

For Examination of the Anterior Chest, a baby is usually best held in the lap. Sit opposite the doctor and hold the child with its head falling slightly backward. Keep one of your hands upon its legs and hold its hands above its head with the other.

To Restrain a Child with a Sheet.—Occasionally it is well to restrain a child for the giving of treatments by wrapping it in a sheet or a blanket. To do this, put a sheet[1] under the child, leaving the sheet longer on one side than the other; pass the shorter end over the child's chest, bring the corner down over the shoulder and diagonally across the chest; bring the upper part of the other side over the other shoulder, make a fold in the sheet to adjust it to the child's body, and wind it about the body. It should be long enough to go around twice. Success in keeping the arms down will depend upon getting the upper ends of the sheet firmly adjusted over the shoulder and in making them secure by the part of the sheet that is passed about the body.

N. B.—Never let a child know that you want to restrain it. If it is old enough to understand, talk to it and divert its attention. Be gentle, but firm, in your hold of the child.

Preparing the Patient for the Night

To prepare a patient for the night, wash her face, hands, arms, axilla, and back with hot[2] water and soap,

[1] A bed sheet is better than a crib sheet for the purpose. The latter is too small.

[2] Unless a patient desires it, do not use cold water.

dry one part before proceeding to another, rub her back with alcohol and dust it with powder. Freshen the bed by shaking and turning the pillows, drawing a portion of the draw sheet through, sweeping out the crumbs and straightening the top clothes.

Preparation of the Ward

In the hospital, before the day nurses go off duty, they must see that the ward cupboards, lavatories, etc., are in perfect order, and that there is on hand a plentiful supply of all necessaries, such as dressings, medicines, solutions, milk, broth, etc. They should also remove all cut flowers from the ward, and see that no soiled clothes or garbage are left in the lavatories or pantries.

Care of Patient at Night

Condition of Ward.—Sleep and rest are very important items in the treatment of the sick, and a thoughtful nurse will do all within her power to secure conditions conducive to sleep for her patients. The most important conditions are quiet, good ventilation, cool air—about 65° F.—darkness, or at least absence of bright light. Wards should be quiet and all but necessary lights out by eight o'clock. Lights that must be used are to be shaded.

Means of Inducing Sleep.—First, the patient must be comfortable. If she is not, turn her pillows and do what you can to make her so; if the weather is warm, or if the patient has a high temperature, rubbing her with alcohol and fanning her dry may help. As a slight anemia of the brain tends to induce sleep, something to eat or a hot drink, especially hot milk;

FIG. 13

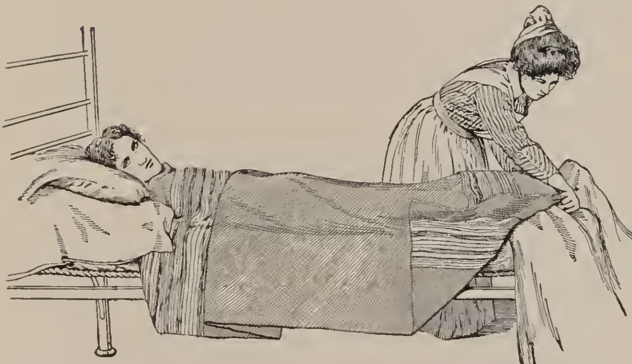

FIG. 14

massage of the neck, arms, and back; hot-water bags at the feet and on the abdomen will often, by taking an extra supply of blood to another part of the body, be successful. Medicines to induce sleep—narcotics—are, of course, ordered by the doctor, but, except in special circumstances, he does not want a narcotic given if it can be avoided, and, ordinarily, it should not be, until several of the simple mechanical means of inducing sleep have been tried. The majority of narcotics are cardiac depressants and producers of constipation, and their use is always attended with the danger of inducing a craving for them, and thus creating a drug habit. *A good nurse gives very few narcotics.*

WATCHFULNESS.—Be watchful and observing. Patients are always likely to be weaker at night than in the daytime, and sudden changes for the worse take place much more frequently. Note the character of the pulse of all sick patients early in the evening, so that you will be able to detect any change. Patients are also much more likely to become irrational at night, and you must therefore be always on the watch to see that they do not get out of bed. Report at once any signs of restlessness in a patient whose history would suggest the possibility of an attack of delirium tremens. Notice when patients do not sleep well; you should be able to give an accurate account of the number of hours all particularly ill patients sleep.

EXTRA COVERS.—As the night advances, the air grows colder and people's vitality is lowered; therefore, give extra blankets toward morning, not only to patients who complain of cold, but to all whose condition makes extra warmth advisable. With care,

a blanket can be easily put over a sleeping patient without waking her.

Care of the Mouth, etc.—It is important to realize that sordes will collect in the mouth and a bed-sore form quite as readily during the night as during the day. Consequently, it is quite as important that the mouth be washed out after feeding during the night as during the day, and also that the parts where there seems to be a tendency for the tissue to break be cared for. As the patient's rest is not to be disturbed more than necessary, keeping pads or rings under the affected parts can constitute a considerable part of this care during the night, but the affected parts should be rubbed with alcohol two or three times during the night.

Night Nurse's Morning Work.—In the majority of hospitals, other than private ones, the night nurse is required between the hours of 5:30 and 7 A.M. to see that all the patients have their hands and faces washed, teeth brushed, and hair arranged, and she must do all this for those who are not able to do so for themselves; also she must see that the ward, pantries, and lavatories are in order.

How to Comb the Hair

Only a dying patient should be considered too ill to have her hair cared for. If it is done daily and done properly, its arranging will not entail any exertion or discomfort for the patient. If, however, it has been neglected, it is likely to be very tangled, and if the patient is very ill, the tangles may have to be removed by degrees. To do the hair, cover the pillow with a towel, part the hair in the center, from the

forehead backward, brush and comb each strand separately and plait the one first attended to before beginning to brush the other. Begin to comb at the end of the hair and work upward, and, if there are any tangles, hold the hair firmly between the head and the tangles which you comb. Braid the hair close to the ears. If the hair is very tangled, wetting it with alcohol 50% or sweet oil or vaseline will assist in getting out the snarls. If all the tangles cannot be removed at once, divide off a small portion of the hair and when that has been freed from snarls braid it; then, as soon as you have time and the patient is rested, do another portion, and braid it, and so on until all the tangles are removed. The care of the hair when the head is infected with vermin will be discussed in connection with washing the hair, in the chapter on baths.

Proper care of the hair during illness may do much to prevent its falling out; brushing stimulates the growth of the hair, and massage of the scalp does this also, and in addition keeps the scalp loose and improves the circulation around the roots of the hair, two essential conditions for the nutrition of the hair.

Night Report

The night nurse should write a clear and concise, but detailed, report of all treatment, medication, and nourishment given during the night. She should also record significant symptoms and all changes in the patients' condition, and mention the fact if patients have not slept well, and, as previously stated, she should be able to give an accurate account of the length of time particularly sick patients slept.

Summoning Friends

Whenever a patient becomes so much worse that there is danger of death, her friends must be notified. In the daytime the head nurse attends to this and a night nurse, not being accustomed to the duty and probably having a great deal of extra treatment to give at the time, is likely to forget it, unless she makes a strong endeavor to remember. The doctor's permission is asked before notifying the friends.

Care after Death

As soon as a patient has stopped breathing, straighten the limbs, close the eyes by pressing the lids down with the fingers. If the latter will not stay closed, place a wet eotton pledget upon them. If the patient had false teeth put them in, and place a tightly rolled bandage or other support under the chin to keep the lower jaw closed. In the hospital, nothing more is done until the doctor has seen the patient and pronounced life extinct. After this formality has been gone through and the friends have left, wash the body. A disinfectant is usually used for the purpose, but this is not necessary unless the patient died of a eommunicable disease. If there is a wound, apply fresh dressing; brush and braid the hair[1]; fasten a triangular binder, with a large oakum pad[2]—about 25 inehes square—in the eenter, around

[1] In private nursing, the hair is generally arranged in the manner in which it had been usually worn, and a nightgown put on instead of a shroud.

[2] Formerly the orifiees were plugged to prevent the escape of post-mortem discharges, but this has been discontinued because it often eaused the body to become bloated and disfigured.

the loins like a child's diaper; tie the knees together with a broad bandage and also the ankles; put on the shroud; tie the wrists together, and cover the body with a sheet. In large hospitals, it is necessary to attach a card—usually to the wrists—bearing the patient's name and age, the name of the ward, and the date.

CHAPTER VII

CLEANSING BATHS

Different Methods of Giving Cleansing Baths. Washing the Hair. Symptoms of and Treatment for Pediculosis. Infants' Cleansing Baths: Sponge, Tub, and Spray.

The Cleansing Bath

WHY NECESSARY.—A patient lying in bed may not look dirty, but, nevertheless, she needs to be bathed quite as often as a healthy person. The reasons for this are: (1) The skin, in addition to various other functions, serves as an excretory organ, and the excretions—perspiration and sebaceous matter,—though they consist largely of water, contain organic substance, which, if not removed by washing, decomposes and gives rise to an unpleasant odor; also it may be the cause of pimples, and these are not only a source of annoyance to the patient, but, worse, they favor the formation of bed-sores. (2) Bathing stimulates the circulation of the blood in the small capillaries of the skin and thus aids in its various functions. (3) To the majority of people the bath is very refreshing.

Bath Temperatures

A bath with a temperature between:

55° and 65° F. is known as a cold bath
65° and 75° F. is known as a cool bath
75° and 85° F. is known as a temperate bath
85° and 92° F. is known as a tepid bath
92° and 98° F. is known as a warm bath
98° and 112° F. is known as a hot bath

How Many Baths Necessary.—Private patients and very sick patients are usually bathed every day, but, unfortunately, the amount of work to be done in a general ward does not allow of all the patients being bathed so frequently; therefore, the rule in most hospitals is that all patients are to be bathed at least twice a week, and every nurse should feel that she must, no matter how busy the ward may be, make every effort to bathe her patients at least this often.

Time for Baths.—The ideal times for a patient's bath are about an hour after breakfast or before retiring, but in the hospital ward, where each nurse has several patients to care for, the baths have to be given at odd times during the day, as the work of the ward permits. It is imperative, however, that at least one hour intervene between the eating of a meal and the giving of a bath. The reason why this delay is necessary being that the bath, by exciting the cutaneous nerves, improves the circulation of the blood in the skin vessels and consequently increases the amount of blood in the derma, and this takes away some of that which went to the stomach, intestines, etc., as soon as the entrance of food into those organs irritated their sensory nerves. This action interferes with digestion, since the extra blood is needed

by the secretory glands of the stomach and other organs concerned in digestion, for the manufacture of the juices which are essential for the digestion of the food.

Methods of Giving Cleansing Baths

Tub Baths.—The following are the points to be remembered in connection with tub baths:

(1) Junior nurses should ask permission of the head nurse or senior before allowing a patient to have a tub bath, either on admission or when she first gets up.

(2) See that the bath-room is warm.

(3) Provide a bath towel, face towel, wash cloth, nail-brush, and soap.

(4) Fill the tub half full of water about 96° F., not hotter. Let the cold water run in the tub before, or at the same time as, the hot.

(5) Even when a patient is able to take her own bath, she should not be allowed to lock the door, nor be left long alone.

(6) She should not be allowed to remain in the bath longer than ten minutes.

(7) Even when a patient takes her own bath, you are responsible for her cleanliness. You can help her undress, and while so doing, judge from existing conditions how much supervision of the bath is necessary.

(8) As soon as the patient is dressed, wash the bath-tub and tidy the bath-room.

Method of Giving a Biweekly Cleansing Bath when a Patient Is not very Ill

(1) See that the window near the patient's bed is closed and that the room or ward is warm.

(2) Bring to the bedside everything that will be required, viz.: A bath blanket, at least two towels—a face and bath towel—a wash cloth, a toilet basket—containing soap, ammonia, alcohol, mouth wash, nail-brush, orange sticks, cotton, combs, whisk, and toilet rubber—a foot tub half full of water, 100° or 105° F. If the sheets are to be changed, bring the clean ones.

(3) Draw the patient to the side of the bed.

(4) Replace the top covers with a blanket. For method of doing this see page 191.

(5) Pass the far side of the blanket as well under the patient as you can, then raise her head and shoulders and draw the blanket through under them; flex her knees, raise her buttocks, and draw this part of the blanket through; raise her feet and pull the rest of the blanket into place. If the blankets are small, two must be used. In such case, put one over and the other under the patient, putting the one under her as you do a sheet when making a bed.

(6) Proceed with the bath. In washing, exert a firm, but gentle pressure; dry each part immediately. Wash and dry the ears, between the fingers and toes, the axilla, and the pubic region particularly well. Proceed in the following order: face, ears, neck, chest, arms and hands, abdomen, back, thighs, legs, feet, pubic region. Unless there is some reason why the feet should not remain in the water for a few minutes, before beginning to wash the thighs, put the feet in the tub and let them remain there until after they have been washed. To put the feet in the tub: Flex the patient's knees, put the tub on the side of the bed near the feet, under the blanket, place your arm that is nearest the foot of the bed across the

tub[1]—this prevents the blanket getting into the water; at the same time, put your hand nearest the patient under her heels, with your arm support her legs, raise the legs and feet and, at the same time, draw the tub into place and put the feet into the water. This, like the rest of the bath, can all be done under the blanket. To take the feet out: fold the bath towel and place it on the far side of the tub, take hold of the feet and the tub as before, raise the feet, hold them over the tub for a moment, place them on the towel, then draw the tub out, your arm being across it while doing so, that the blanket may not get into the water; remove the tub from the bed, dry the feet and. if necessary, clean and cut the nails. Take the blanket from under the patient. To do this: turn her slightly on one side, roll the blanket as far under her as possible, turn her back on the bed, draw the blanket from under her, remove the blanket and pull up the covers at the same time. To do this: catch hold of the lower end of the blanket and the upper part of the bedcovers and draw them up; then pull the blanket from under the covers. Inspect the finger nails. If they need attention, put the toilet rubber and towel under the hands and cut the nails.

To Bathe a very Ill Patient.—When a patient is very ill, it is often advisable to turn her as little as possible. In such case, cover her with a bath blanket as described on page 191, but do not put it under her. Instead, protect the bed by placing a bath towel under each part as you wash it. It is often well to keep a hot-water bag at the feet during the bath.

Admission Bath.—It is often essential to use soap

[1] See Fig. 13.

and water more liberally when bathing a patient on admission than when giving a daily or biweekly bath; therefore, it is usually better to put a rubber under the bath blanket and to have two blankets. Usually, as stated in Chapter VI., before a patient is lifted from the stretcher to the bed, a rubber sheet covered with a blanket is spread upon the latter and the patient, after being placed upon this, is covered with a second blanket, under which she is undressed, as described on page 161, and bathed. If the patient is very dirty, it may be necessary to expose the part that is being washed. When washing a dirty patient, it is also well, after washing the face, to put a little ammonia in the water, and if the feet are very dirty or are much calloused, to use sapolio when washing them, and it is sometimes well, after washing, to wrap them in gauze or a small towel, wet in hot—112° F. —soap-suds, and cover this with a dressing rubber—so that the bed will not be wet. They will probably need to remain thus for half an hour or an hour, and then to be washed again. When washing the feet the second time, you can raise the covers from the foot of the bed and turn them back to expose the feet. The rubber and towel in which they have been wrapped will serve to protect the bed.

Method of Replacing Top Bedcovers by a Blanket.—When preparing a patient for a bath and for many treatments, it is necessary to replace the bedclothes, covering the patient with a blanket or sheet. One way in which, after a little practice, this can be done quickly, deftly, and without exposure of the patient, is as follows: Fold the blanket or sheet that is to be used in four, having the top and bottom edges one on either side of the middle fold.

Place the blanket across the patient's chest. If she is well enough, have her hold the end; if not, tuck it under her shoulders or under the pillow. Take the other edge, on either side the bed, between your third and little fingers; take hold of the covers between your thumbs and free fingers and fold them down to the foot of the bed, making about four folds. As you are holding on to the blanket, it is unfolded over the patient as the covers are folded. It takes a little practice to do this quickly, but after practice, it can be done quite as readily as by any careless, untidy method, and it saves unnecessary crushing of the sheet and spread, an untidy appearance and exposure of the patient.

Washing the Hair.—If the hair is to be washed, it is better to do it after the bath is completed. To wash the hair, have ready: a small pitcher of soap solution and one of cold water, and a large pitcher of hot water—about 112° F.—a foot tub, a small and a large rubber, two towels. Bring the patient well over to the side of the bed, cover the pillow with the small rubber and this with a bath towel, bring the lower corners of these around the neck and pin those of the towel. Roll the sides of the large rubber and place it under the head with the lower roll in the curve of the neck. Put the tub on a chair or stool and arrange the upper pillow so that the trough formed by the rolled rubber slopes gradually from a few inches beyond the far side of the head into the tub. Unbind the hair and spread it out in the trough. Pour first the soap solution and then some hot water over the hair and scalp, rubbing these well at the same time—the hot water can be poured over the head from the pitcher that held the soap solution, because

if a pitcher is large enough to hold all the hot water required, it will be unwieldy to use; after the soap has been well washed out, pour a little cold water over the scalp, rubbing the latter well at the same time; then pour some hot water over the hair. Get all the water out of the trough; dry the hair as well as possible, and remove the trough. Spread the hair out over the towel, covering the pillow, and let it remain thus until dry, giving the scalp an occasional rub and the hair a shake, while it is doing so.

Care of Hair if Pediculi are Present.—If a newly admitted patient's head looks dirty, examine it carefully *before giving the bath—pretend that you are combing it while doing so, that the patient may not suspect what you are doing.* If pediculi are present, cover the pillow with a rubber and this with a towel; pour enough tincture of delphine, tincture of quassia, carbolic 1:40, or bichlorid of mercury 1:2000 over the scalp to wet it and *the hair next the scalp thoroughly*, bind the towel around the head and tie or pin it at the forehead. Leave the head thus for at least two hours, then comb it with a fine-tooth comb, and, afterward, wash it as previously directed. As soon as the hair is dry, use some more parasiticide, if there are any nits on the hair; wet the hair—not the scalp—with hot vinegar, let it dry once more, then comb it with the regular comb until tangles are removed and then use the fine comb again; braid the hair. An application of the tincture of delphine and hot vinegar should be made daily until there is no sign of either pediculi or nits. If the head is at all badly infested, it is well to keep a towel or triangular square of cotton tied around it, turban fashion, and when removing bedclothes from the bed, to gather them up care-

fully and put them into a disinfectant. The hair may be in such a condition that it will be necessary to cut it, but nurses must never do this without permission of both the patient's friends and the hospital authorities.

The two first named parasiticides are the best to use. They do not injure the hair. Kerosene is a good parasiticide, but on account of its odor, it is very unpleasant to use. A patient, on whose head it has been used, should be cautioned not to go near fire until the oil has all evaporated.

SIGNS OF THE PRESENCE OF PEDICULI.—(*a*) Itching of the head caused by the lice crawling on the scalp and puncturing it for the blood on which they feed; (*b*) there may be eczema extending to the neck and behind the ears, and (*c*) some of the lymph nodes of the neck may be enlarged.

NITS.—The nits are the eggs of the lice, and if they are allowed to remain on the hair, they will develop into pediculi. The nits look like dandruff, but they cling tenaciously to the side of the hair, while dandruff is easily brushed off. The outer substance of the nits is of a gelatinous nature, which the parasiticide cannot penetrate and, therefore, it will not destroy them, but this the vinegar does, by dissolving them.

BODY LICE.—It was stated in the preceding chapter that while undressing a patient abnormal conditions were to be looked for and scratches were mentioned as one of the important things to be noticed. One of the several things that scratches may be due to is the presence of lice, and this is particularly likely to be the cause if the scratches are around those parts of the body that are covered with short hair, as the pubes, axilla, eyebrows, or in parts that are covered

by the bands or seams of clothing. The reason for this is that one form of these parasites—called the *pediculus pubis*—infests the parts of the body, other than the head, that are covered with hair, and the other, called the *pediculus corporis*, or body louse, inhabits the seams and gathers of clothing, but feeds on the body; this latter variety has to be looked for in the clothing.

Treatment.—The body is bathed with bichlorid solution 1:2000 before the cleansing bath, and if the pediculus pubis is present, an application of some form of mercurial ointment, after the bath, is usually ordered. The treatment of the clothing was discussed in the preceding chapter.

Methods of Bathing Infants and Small Children

Temperature of Room and Water.—Have the temperature of the room in which a baby is to be bathed 70°–75° F. The proper temperature to have the water may be determined by the following table:

For an infant under three months......	95 to 100° F.
For an infant three months and upward	90 to 96° F.
For an infant one year................	85 to 90° F.
For an infant two years...............	75 to 80° F.

Bathing of Small Infant.—As a rule a baby is not put into a tub until it is two or three weeks old. To bathe a baby under this age, envelop it in an old soft blanket or square of eider-down flannel covered with a soft towel, and hold it in the lap. Protect the lap by wearing a padded or Turkish toweling apron. For the bath, use Castile or a good oil soap. Pay particular attention to the eyelids, ears, buttocks, and all sur-

faces where two folds of skin come together. In little girls, separate and cleanse around the labia; in little boys, once or twice a week draw the foreskin back to see that there is no dried urine, etc., adhering to the penis.

N. B.—While giving the bath, do not expose the infant more than is required for inspection, and dry each part as soon as it is washed.

Powdering the Baby.—Powdering the baby's body helps to dry it and prevents chafing where two surfaces come together, as in the axilla, groin, and between the buttocks. Its use, however, is not necessary except in hot weather, to prevent chafing, and unless a pure variety is at hand it is best not to use any; much should never be used.

Infant's Tub Bath.—When putting the baby in the tub, have your left hand under its head and shoulders, with one finger extending into the axilla, and hold the legs with your right hand. Keep your left hand in the same position during the bath and wash with the right hand. Do not keep the baby in the tub more than two or three minutes. When lifting it from the tub, hold it in the same manner as when putting it in. Have your lap protected with a rubber apron, a small bath blanket, and a towel. Lift the baby on to this, roll the towel and blanket around it, and rub over these to partially dry the baby. Then with another warmed towel, finish the drying, being careful not to expose the infant while doing so.

After a child is two or three years old, it is well to conclude the bath by spraying him with water 70° F., having the water in which he is standing about 80° F. The reason for this will be found on page 285.

Spray Baths.—In many hospitals, bath tubs for children have been abolished, as they are thought to be a source of infection. Marble slabs sloping to a sink have been substituted with sprays to convey the water from the tank in which it is contained. The

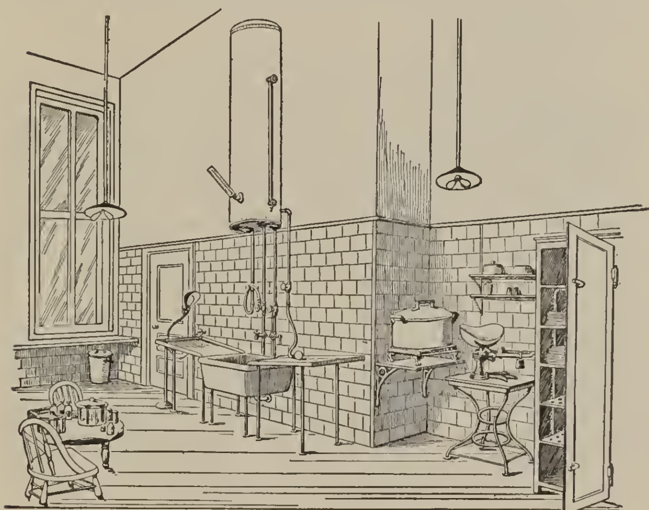

Fig. 15

figure shows the arrangement used in the Presbyterian Hospital in the city of New York. In consists of an eight-gallon copper tank, which is connected with the hot- and cold-water pipes. These terminate within the tank in four small points, those of the cold-water pipe pointing upward and those of the hot-water pipe, downward. This arrangement causes the current of the two streams to go against their gravity tendency, and thus a thorough intermingling of the two streams is effected and the water in the tank

made of uniform temperature throughout. The flow of water into the tank is caused and discontinued by turning the valves, which are on the pipes, a little above the sink. A water gauge on the side of the tank shows the depth of the water within the latter, and a thermometer projecting from the front shows its temperature.

Method of Giving Bath.—Each morning, at bath-time, the tank is filled with water the required temperature, 103° F. This, it has been found, insures a spray of a temperature of 100° F., and this temperature is maintained, within one or two degrees, for from three to four hours. The baby, after being undressed, is laid on a clean bath towel, sponged with soap-suds, and sprayed. It is then dried with a warmed towel, rolled in a warmed blanket, and dressed.

After use, the towels and wash cloths are boiled in the sterilizer (see Fig. 15), dried in a drier provided for that purpose, and, when dry, folded and kept in a heated closet.

CHAPTER VIII

SYMPTOMS AND PHYSICAL SIGNS

Nature of Symptoms and Physical Signs. Classification of Symptoms. Significance of Some of the More Important Subjective and Objective Symptoms. Causes of Important Abnormal Conditions that can be Discovered by Inspection. Nature of, and Reasons for, Physical Examination of Patient by Physicians. Preparation of Patient for Physical Examination by Physician. Charting.

BEFORE taking up the study of the procedures of the various treatments in common use for the cure and relief of the sick, it will be well to learn something of the conditions which the treatments are intended to relieve and of the signs or symptoms by which these conditions are recognized.

Nature of Symptoms and Physical Signs.—A symptom has beeen defined as "*Any evidence of disease or of a patient's condition; a change in a patient's condition indicative of some bodily or mental state.*" By physical signs are meant *conditions that can be seen, heard, or felt by the diagnostician.*[1] Such signs are discovered by (1) inspection, *i. e.*, examination by sight; (2) auscultation, *i. e.*, listening; (3) palpation, *i. e.*, feeling with the hand; (4) percussion, *i. e.*, *striking a part with short, sharp blows as an aid in diagnosing*

[1] W. A. Newman Dorland, A. M., M.D.: *The American Medical Dictionary.* W. B. Saunders & Company.

the condition of the parts beneath by the sound obtained. Nurses are not responsible for the last three methods of discovering abnormal conditions, but they must be quick to observe all those that are discoverable by inspection.

Classification of Symptoms.—Symptoms have been classified as (1) objective—those which can be seen by an onlooker; (2) subjective—those which are complained of by a patient and are not perceptible to the observer.

Reasons why Nurses should Understand Significance of, and Observe, Symptoms.—Nurses should have a clear idea of the significance of the more common symptoms likely to occur as the result of abnormal conditions of the body; otherwise they will not be likely to observe, with the necessary promptness and accuracy, the symptoms that may arise in the course of a disease. Two important reasons why nurses must be able to observe with exactness and report intelligently are: (1) The physician makes his diagnosis and bases his treatment almost entirely on the symptoms exhibited by the patient, and as these symptoms are often transitory, he must often depend upon the nurse for his knowledge of them. (2) Prompt recognition of symptoms indicating a change for the worse in a patient's condition, is often of the utmost importance, for immediate treatment may be the only means of saving the patient's life. As such symptoms are not always very obvious, it is exceedingly important that nurses should know the various conditions that are likely to occur, or that have special significance, in each of the more fatal diseases, as she is then more likely to recognize them.

Comparative Value of Subjective and Objec-

TIVE SYMPTOMS.—Subjective symptoms are often, owing to the youth or condition of the patient, impossible to ascertain; and when they can be ascertained, they cannot always be relied upon. Objective symptoms are, therefore, usually of much more importance than the former, and they often help in verifying and elucidating the patient's description of his subjective symptoms.

IMPORTANT SUBJECTIVE SYMPTOMS.—Some of the more important subjective symptoms are pain and other abnormal sensations, such as chilliness, dizziness, headache, nausea, throbbing numbness, lack of sensation, defects of hearing, vision, and taste. The significance of these and of many of the important objective symptoms and conditions that can be discovered by inspection are as follows:

Breath

The odor of the breath often assists in diagnosis, therefore any abnormality in it should be noticed and charted. A sweet odor may indicate diabetes; an odor of urine, uremia; a fetid odor may be due to a deranged stomach, ulcerated teeth, chronic catarrh, or certain lung diseases.

Chill

Chill, or rigor, indicates an unequal distribution of heat between the interior and the exterior of the body. The blood-vessels of the skin are contracted, and the blood is driven to the interior. This condition may be caused by contact with something colder than the body; or it may be the result of nervous irritation, due

either to some disorder of the nervous system, to the toxic poisoning of disease, or to cerebral pressure. A chill frequently marks the onset of certain diseases, such as pneumonia and the exanthemata. Chills vary in intensity, from slight shivering sensations to movements sufficiently powerful to shake the bed, and they may last from a few seconds to an hour or more. Their severity and duration should always be charted; also their effect upon the temperature, pulse, and respiration. After a chill, the temperature is usually taken and recorded every hour until it falls to the average degree registered before the attack. Chills due to nervous conditions, as hysteria, are not, as a rule, followed by any marked rise of temperature, but when due to other causes the rise may be very great, reaching 105°–106° F.

Sensations of chilliness, not connected with change of temperature, will be considered in the paragraph on sensations.

Color

The color of the skin is of great diagnostic value in many diseases, and change of color is often one of the first indications of a change for the worse in a patient's condition. Among the color symptoms are: the yellow that denotes jaundice or lead poisoning; the sallow complexion of opium slaves; the sallow waxy skin of carcinoma; the waxy, yellowish shade often accompanying Bright's disease; the extreme pallor of hemorrhage and shock; the white skin and white mucous membranes of anemia; the bluish tint of cyanosis; the flushed face of high fever; the hectic flush of phthisis; and the single red cheek often present in

pneumonia, when only one lung is consolidated; the gray color typical of silver-nitrate poisoning; the bronze shade of Addison's disease, which shade is also often present, to some extent, in diabetes and cirrhosis of the liver.

Coma

Coma is a state of prolonged unconsciousness from which the patient cannot be aroused. The more common causes are: Apoplexy, certain drugs, depression of the nerve centers from any cause, epilepsy, hysteria, injury to the brain, sunstroke, diabetes, and uremia. Except in hysteria, sometimes in epilepsy, and when produced to a modified extent by the normal action of drugs, coma is a very serious symptom, as it usually denotes great depression of the nerve centers. The condition of coma in which the patient lies with open eyes, is often spoken of as *coma-vigil*. Temporary unconsciousness due to anemia of the brain is termed *syncope*. This condition may be caused by general anemia or interference with the heart action, as by fright, weakness, heart disease, or muscular relaxation such as is occasioned by the use of hot baths.

Convulsions

A convulsion is a condition of excessive muscular contractions, occasioned by an involuntary discharge of motor impulses from the nerve centers. The contraction may be intermittent or continued, general or local. Intermittent contractions are termed *clonic;* continued ones, *tonic;* local convulsions, *i. e.*, contractions confined to one muscle or a group of muscles,

are often spoken of as *spasms*. Convulsions are often classified as (1) *epileptiform*, (2) *tetanic*, (3) *hysterical*.

Epileptiform Convulsions.—The principal characteristics of the convulsions classified on this variety are: (1) loss of consciousness, (2) the contractions are chiefly clonic. The more common causes of epileptiform convulsions are: (1) Idiopathic epilepsy. (2) Organic brain disease. (3) Toxic agents in the blood, such as are developed in infectious fevers and in uremia, and certain drugs, as alcohol. (4) Reflex irritation; of this nature are the convulsions common in young children, as the result of gastric or intestinal irritation, adherent prepuce, or teething. (5) Cerebral anemia; examples of convulsions from this cause are: convulsions following severe hemorrhage, those occurring in poisoning by drugs that are cardiac depressants, or in heart disease.

Eclampsia.—The term eclampsia is often applied to sudden attacks of convulsions occurring as the result of a temporary cause, such as convulsions of childhood that are due to reflex irritation, and the convulsions of pregnancy due to the presence of toxic substances in the blood.

Tetanic Convulsions.—The chief characteristics of the convulsions so classified are: (1) The nerve impulses emanate from the spinal cord and not from the brain, therefore there is not necessarily a total loss of consciousness. (2) The contractions are, for the most part, of a tonic nature. The principal tetanic convulsions are: (1) Tetanus convulsions which are due to toxic substances produced in the body by the bacillus tetani. One of the characteristic symptoms of tetanus convulsions is the early involvement of the jaw. (2) The convulsions of meningitis due largely

to pressure on parts of the brain or spinal cord by the fluid resulting from the inflamed condition of the meninges. (3) Strychnine poisoning.

Hysteric Convulsions.—These are manifestations of hysteria and vary in nature. Consciousness is only partially lost if it is at all; the movement may be either tonic or clonic, and the paroxysms are usually of long duration. The points to be noted in connection with convulsions are: the frequency and duration of the paroxysms; whether they are general or whether only certain parts of the body are involved; whether the eyes are affected, and in what way; whether there is any frothing at the mouth; whether the color, pulse, and respiration change; and whether the attacks are followed by a rise of temperature.

Cough

A cough is generally a symptom of irritation in some part of the respiratory tract, but is caused, at times, by a reflex nervous irritation. Its character will often indicate the cause. There is the short, sharp cough of nervousness; the deep, forcible cough of bronchitis; the wheezing, distressed cough of asthma; the small, hacking, constant cough of phthisis; the shallow, painful cough of pneumonia; the peculiar, hoarse, crowing cough of croup; the convulsive cough followed by a whoop, of whooping-cough; the peculiar ringing cough, often present in aneurism of the aorta; and the distressed, breathless cough which is so frequently an accompaniment of heart disease and which is due to the constant irritation caused by dyspnea. In addition to noting the character of the cough, it should be observed whether it is worse by day or by

night, and whether it is accompanied or not by pain and expectoration.

Cry

Even a cry, especially in a child, is sometimes diagnostic. The moaning, wailing cry of an infant while ill is very different from its cry of temper. When crying because of hunger, a baby generally sucks its fingers at the same time and ceases crying as soon as it is fed. The cry of colic is continuous and loud, and the child, when emitting it, writhes and twists its body. There is a peculiar sharp, ringing cry typical of hydrocephalus and meningitis.

Cyanosis

Cyanosis indicates the imperfect oxygenation of the blood. It is often a grave symptom.

Delirium

Delirium is the term applied to the psychic disturbances that sometimes occur in the course of disease. It is more common in diseases in which the temperature remains persistently high; in diseases in which toxic substances are produced, either as the result of constitutional disturbances or by bacteria; in nervous individuals, and those addicted to the overuse of alcohol. The two main types of delirium are: (1) Violent or wild delirium, in which the patient is in a state of constant unrest, even violent, and is usually very noisy. Of this nature is the delirium of alcoholism, *delirium tremens*. (2) Low muttering delirium, in which the patient talks more or less con-

stantly, but not loudly; he may or may not be restless, but is not violent. Such delirium is characteristic of typhoid fever. Delirium may occur suddenly, or it may come on gradually, the patient growing constantly more restless and becoming possessed of strange ideas. Such symptoms should be always noted and reported, for this is very frequently the way in which an attack of delirium tremens begins and the attack may often be averted if treatment is started in time. That this should be done is very important, for no matter how ill the patient is he will, during the attack, become temporarily very strong, and may injure himself or others; also, if it is necessary to restrain him, he may fight so strenuously against the restraint that his heart may not be able to stand the strain and sudden death will result.

Dizziness or Vertigo

Vertigo is a very common complaint in neurasthenia; also in old age, due to senile changes in the heart and blood-vessels and consequent anemia of the brain. Cerebral anemia, and consequently dizziness, is caused also by diseased states of the heart and blood-vessels. A very serious cause of vertigo is *Menière's disease*, a disease of the inner ear, more especially the semicircular canals. Other causes are: suppurative states of the middle ear, wax in the ear, eye strain, indigestion, constipation, disordered states of the liver, overuse of tea, coffee, and alcohol.

Dysphagia

Dysphagia, difficult swallowing, is most commonly due to one or other of the following causes: Inflammation of the throat or larynx; stricture of the

œsophagus due to cicatrix or disease; pressure on the œsophagus; hysterical spasm of the œsophagus; paralysis of the muscles of deglutition. This last condition is one of the most common complications of diphtheria. Regurgitation of food is the primary symptom; therefore, whenever this happens it should be reported.

Dyspnea

Dyspnea is the term applied to difficult breathing. When the condition is so severe that the patient can breathe only when in the sitting posture, it is known as *orthopnea*. Dyspnea may or may not be accompanied with increase in the rate of respiration and pain. The principal causes are: abdominal distention, anemia, asthma, cardiac disease; diseases of the lungs, such as pneumonia, edema, emphysema, abscess, and gangrene; obstruction in the larynx from any cause; pleural effusions; paralysis of the muscles of respiration; pressure upon the trachea, a bronchus, or the recurrent laryngeal nerve—the more common causes of such pressure are aneurism, enlarged glands, or tumors. Dyspnea and other abnormal forms of respiration will be further considered in Chapter X.

Edema

Edema is the term applied to an unnatural collection of serous fluid, derived from the blood, in the tissues or cavities of the body.

The more common causes of edema are: (1) Increased permeability of the capillary walls and abnormal pressure changes, such as may occur in nephritis. (2) Chronic visceral diseases that result

in venous stasis—*e. g.*, heart disease, cirrhosis of the liver. (3) Inflammatory conditions, as pneumonia, pleurisy, meningitis. (4) Changes in the composition of the blood, as in severe anemias. (5) Local obstruction to the venous circulation, as by thrombi, or by pressure upon the veins or capillaries by tumors, etc. (6) Defective innervation, as in hysteria, neuritis, or following injury of a nerve.

Edema due to anemia is usually confined to the feet and ankles; that due to heart and kidney disease may affect different parts of the body or may involve the whole body. It may be well marked in some parts and be very slight elsewhere. It generally appears first either in the face, especially the eyelids, or the feet and ankles. The edematous parts are pale and swollen, and, sometimes the tissues are so infiltrated with fluid that it oozes through the skin.

The parts of the body in which the presence of edema is attended with the greatest danger to life are the throat, the lungs, the brain, and the pericardial sac.

Edema causing swelling in the tissues covering the framework of the body is often spoken of as dropsy, and when the dropsy involves a large portion of the body the technical term is *anasarca*.

A collection of serous fluid in the abdominal cavity is called *ascites*. Liquid in the pleural cavity is known as *hydrothorax*. When the cerebro-spinal fluid increases in quantity sufficiently to enlarge the head, the condition is known as *hydrocephalus*.

Expression

A pinched, anxious expression is characteristic of many forms of heart disease in all their stages, but, in

the majority of illnesses, it generally signifies a change for the worse. It is also a symptom of hemorrhage. A dull, apathetic expression usually indicates a serious illness; it is particularly marked in typhoid fever, and its disappearance is always considered a sign of improvement. An over-alert, excited expression indicates mental derangement. It is of special moment when a patient has an alcoholic history, since it is often one of the first signs of an attack of delirium tremens.

Eyes

The appearance of the eyes is often an index of the patient's condition: *e. g.*, a fixed, staring gaze; a shifty, restless movement of the eyes; and a wild, excited look—all indicate mental disturbance. In examining the eyes, notice the condition of the pupils: contraction of the pupils is one of the first symptoms of an overdose of many drugs, such as morphine and several narcotics, while other drugs, such as belladonna, advertise their use in excess by a dilation of the pupil; dilation of both pupils, uneven dilation, and even more frequently contraction of the pupils may be due to pressure on the brain, either from traumatism or disease. In certain brain diseases, photophobia, or sensitiveness to light, exists. In jaundice, the sclerotic coat is streaked with yellow. In high fever, the eyes are glassy and often bloodshot. In wasting diseases they are sunken, while in exophthalmic goitre they are very prominent. Lachrymation (a running from the eyes) is frequently a forerunner of measles. Puffiness under the eyes may indicate kidney complications or arsenical poisoning.

For the symptoms of local disease of the eye, see Chapter XX.

Gums

Some abnormal conditions of the gums that may occur and should be noted are: a blue line on the gums near the insertion of the teeth, which usually indicates either chronic lead, copper, or silver poisoning; spongy, bleeding gums—such conditions are often associated with scurvy and syphilis; swelling of the gums, with tenderness and salivation, a condition known as ptyalism, which is usually due to mercurial poisoning.

Headache

Headache is a symptom that points to many abnormal conditions. Its cause can sometimes be determined by noting the time at which it occurs, its location and nature. Thus headache felt on arising in the morning is often due to sleeping in a badly ventilated room; headaches that occur frequently in the afternoon or evening are often due to debility, nerve fag, eye-strain, anemia, meningitis, and tumors of the brain. Headache due to debility, nerve fag, anemia, inflammation or catarrh of the nose and the cavities communicating with it, and eye-strain, are most commonly felt on the forehead; eye-strain may also cause headache on the top or back of the head, and this may occur from overuse of the eyes without any ocular defect. Pain in the head due to inflammatory conditions of the ear is likely to be felt at the side and back of the head. Headache due to constipation or gastric disturbances is likely to be felt on the

forehead and is often associated with nausea, and, especially when due to the latter cause, the headache is likely to be of a throbbing nature. The location of the neuralgic headache varies according to the nerve affected; the pain is of a stabbing nature. Headache in nephritis and uremia is a serious symptom and its occurrence should be reported to the physician at once, for it is often the forerunner of an uremic convulsion. Headache, also, is often one of the prodromal symptoms of the acute infectious diseases.

Hearing

In some diseases, especially those of nervous origin, the hearing may be very acute. In others, either through injury to some portion of the ear, or to those nerve centers in the brain which govern the sense of hearing, deafness or partial deafness may be present. Any suspicion of deafness, discharge from, or pain in, the ear, should be immediately reported, since disease of the inner ear is likely to complicate many diseases —particularly, the exanthemata, diphtheria, meningitis, typhoid fever, and pneumonia. Improper care of the mouth is one of the frequent causes of the infection. Temporary deafness and ringing in the ears often follow even small doses of quinine. They also occur in weakness and general debility.

Hiccup

Hiccup, or singultus, results from a clonic spasm of the diaphragm associated with sudden closure of the glottis. Hiccup sometimes occurs as a temporary condition after eating or drinking, especially very hot

or highly seasoned food or drink; after violent laughter, and sometimes spontaneously, without apparent cause. Hiccup that is more or less persistent is sometimes present in extreme exhaustion, due to disease, shock, or hemorrhage; in peritonitis, intestinal obstruction, gastritis, appendicitis, typhoid, gastric distention from any cause, toxemia, hysteria, and cerebral tumors. Sometimes it persists for days or weeks in spite of treatment and exhausts the patient.

Inflammation

Inflammation is usually defined as a *morbid condition characterized by pain, heat, redness, and swelling.* It may be caused by (1) chemical agents, as corrosive poisons; (2) physical irritation, as by excessive heat, cold, friction, or electricity; (3) bacteria. The stages in the inflammatory process are as follows: Where the body tissues are irritated by any substance there will be an increased flow of blood to the part. If the irritation continue or if it was originally severe, the flow of blood in the part soon begins to slacken and a condition known as *inflammatory stasis* is produced, and an unusual amount of blood-plasma, also leucocytes, and a small number of red corpuscles pass from the capillaries into the tissues. The resulting collection of fluid in the tissues is spoken of as *inflammatory exudation* and the general condition is called *inflammation*. If the irritation is due to bacteria, certain of the leucocytes, known as *phagocytes*, endeavor to engulf or *eat up* the micro-organisms. If the phagocytes succeed, the exudation, bacteria, etc., will be absorbed and carried away by the blood and lymph. This is known as *resolution*. If, on the other hand,

the phagocytes do not overcome the bacteria, destruction of the former and of body tissue will ensue. The resulting matter, consisting of blood plasma, white cells, dead and living bacteria, and toxic substances produced by the bacteria, is known as *pus*.

Pain

Pain is usually considered a subjective symptom, but a nurse has often to judge of its presence by such objective signs as position, expression of the face, restlessness, and crying. Pain may be general or local; constant or paroxysmal; stationary or shifting. It may be dull or sharp, lancinating, shooting, throbbing, colicky, burning, straining. The presence of pain, the measures employed for its relief, and the result of such measures should be charted.

It is to be remembered that the apparent seat of the pain is not always its source; thus, pain in the breast may be due to uterine trouble; pain down the front of the thigh is often the result of ovarian disease; pain in the knee is frequently one of the earliest symptoms of hip-joint disease.

Paralysis

Paralysis is a sign of pressure upon, or disease or injury of, a nerve or nerves or nerve centers. See Chapter XXV.

Perspiration or Sweating

Profuse sweating may be caused by heat, certain drugs—known as diaphoretics,—or exercise. It is a common symptom of nervousness, and is likely to

occur in any disease during the crisis following a high temperature, and in such case, providing that other conditions are favorable, it is a sign of improvement. If, however, during crisis, or any other time, whether the temperature is high or subnormal, perspiration is associated with a weak heart and cold exterior of the body, it is a very unfavorable symptom, since it shows excessive weakness. Periodic attacks of profuse sweating are common in inflammatory rheumatism and tuberculosis; especially in the latter disease, it generally occurs at night. In rheumatism, the sweat has an acid reaction.

The items to record regarding sweating and sweat are: The hour when the sweating begins and its duration; the amount of sweat—whether slight or excessive; its position—whether general or local; if there is any unusual odor, and also if there are any attending symptoms, as weakness, chilliness, etc.

Position

As the patient involuntarily assumes the position that will give her the least pain and discomfort, position is often a symptom of importance. Thus, in abdominal pain caused by inflammation, the patient will lie on her back, with her knees flexed, in order to relax the abdominal muscles; and, then, even the weight of the bedclothes may disturb her. On the other hand, pain caused by colic, and other disorders of a like nature, is relieved by pressure, and a person suffering from these disorders will probably lie on the abdomen. In diseases of the lungs when only one is involved, the patient will usually lie on the affected side, in order to give the normal lung more freedom

to perform its function. In certain respiratory and heart diseases, a sitting posture is the only one in which she can find comfort. In aneurism she leans forward. In some forms of meningitis, the head is often retracted and the legs flexed.

Rash

Always examine carefully any appearance of rash; for an eruption is often one of the first diagnostic symptoms of the exanthemata. It is also one of the first signs of overdosing with certain drugs, and must be watched for when these drugs are given. Various forms of rash, or urticaria, are caused by diseases of the skin, syphilis, indigestion, nervousness, and many minor disorders. Characteristic forms of erythema are associated with certain diseases; such are the rose spots of typhoid fever and the roseola of cholera, and the rash of measles, scarlet-fever, et cetera. In meningitis, there is frequently a profuse eruption, but it is not constant in character. Herpes is a very common associate of meningitis and pneumonia.

Some forms of purpura, or hemorrhage under the skin, resemble erythema. They are called petechiæ, or ecchymoses, according to the size and form of the spots. They are due to changes in the blood, to obstruction in, or disease of, the blood-vessels, and to traumatism. They occur principally in purpura hemorrhagica, cerebro-spinal fever, the exanthemata, yellow, typhus, and rheumatic fevers. A rash-like irritation of the buttocks in young infants, when not due to lack of care, is often an indication of intestinal trouble or of improper feeding—for instance, an excess of sugar or fat in the food will cause the stools

to have an acid reaction which frequently produces this result.

Any appearance of rash should be reported immediately. Note where a rash first appears and the manner in which it spreads, as this is often of diagnostic value. When there are scratches on the skin as well as rash, examine the pubes and axilla and the patient's clothes for pediculi.

Restlessness

When a patient is convalescent or not very ill, restlessness is to be expected, but in severe illness it is generally regarded as an unfavorable symptom; and the intense, irrational form associated with delirium is not more so than the mere restless plucking at the bedclothes, known as *carphology*. Carphology is indicative of extreme prostration; also it is one of the primary symptoms of delirium tremens.

Sensations

Abnormal sensations, other than pain, often complained of by patients are:

A bearing down sensation—this is the expression frequently used by patients in describing the sensations arising from uterine and bladder disorders.

Chilliness with or without alternating flashes of heat is a sensation common in nervous disorders, especially during the menopause. It is not associated with change of temperature.

Heartburn is the expression often used by patients to express a burning sensation in the esophagus, due to hot, sour, eructations of fluid from the stomach

It is due to a form of dyspepsia characterized by superacidity of the stomach's contents.

Sinking sensation at the epigastrium or, as the patient usually expresses it, *the pit of the stomach*, is usually due to nerve fag, loss of fluid from the body—as after vomiting, frequent evacuations from the bowels, or hemorrhage,—or weakness.

Tenderness should not be reported as pain, for, though painful parts are usually tender, tenderness is not always associated with actual pain.

Anesthesia is a term used to express loss of sensation. It may result from disease of the sensory nerves, from lesions in the spinal cord or brain, from the action of drugs or other toxic substances on the nerves or nerve centers, or from hysteria or reflex irritation.

Hyperesthesia—increased sensitiveness—is often observed in hysteria, neurasthenia, in the beginning of inflammatory conditions of the nerves and cerebrospinal meninges.

Paresthesia is a term that includes certain disagreeable subjective phenomena, such as creeping, itching, tingling, prickling, numbness. These sensations are often due to neurasthenia, defective circulation, or spinal disease.

Sleep

The length of time which a patient sleeps should be noticed and recorded, and also whether the patient sleeps quietly or is restless. Noticing the condition of the patient while asleep is of special importance in the case of children; as much valuable information can be thus obtained. For instance: when the child cannot sleep well unless its head and shoulders are raised on pillows, there is usually some disturbance in

the heart or lungs. If the child sleeps with its mouth open and head thrown back, the presence of adenoids or enlarged tonsils may be suspected. A persistent boring of the back of the head into the pillows is indicative of cerebral disturbance. Restlessness, and sleeping with the eyes half open, point to pain or discomfort.

Teeth

Symptoms Connected with the Teeth.—Delayed dentition and badly formed teeth are often due to rickets or congenital syphilis. The latter disease often causes what are known as Hutchinson's teeth, *i. e.*, the upper, central, permanent incisors are small, conical, and notched at the edge. Caries of the teeth results from many causes, but more especially lack of cleanliness, the use of certain drugs as iron, mineral acids—not food acids—without taking proper precautions, dyspepsia, and diabetes.

The Throat

The condition of the throat is of diagnostic value, not only in local diseases but also in rheumatism, and in many of the infectious diseases. The various throat symptoms found in these diseases are described in the paragraphs treating of them in Chapter XXV. Any appearance of membrane or inflamed condition of the throat should be reported to the doctor at once, especially if the patient is a child.

The Tongue

The membrane covering the tongue being continuous with that which lines the whole alimentary tract,

any change in the latter is advertised by some change in the former. There are also conditions of the tongue which are typical of certain diseases: when it is white and furred, intestinal disorder is indicated, and in some intestinal diseases it is partially denuded of epithelium. It is apt to be red and swollen in diabetes; scarred in epilepsy; punctated like a strawberry in scarlet-fever; ulcerated in mercurial poisoning, stomatitis, or syphilis. Its condition varies also with the different stages of typhoid, and the clearing of the tongue from the edges is a sign of beginning convalescence. Tremor of the tongue is another condition to be noted; it is particularly marked in alcoholism, paretic dementia, and in diseases in which the temperature remains high for a long time, as in typhoid fever.

Tremor or Subsultus

Tremor or subsultus is an involuntary trembling of the body. It is characteristic of alcoholism. Occurring in the course of a disease, it indicates excessive weakness.

Tympanites

Tympanites is distention caused by an accumulation of gas in the stomach or intestine. It is generally due to the fermentation of their contents. In severe illness, flatulence is not only a serious symptom, but, also, a serious condition, since by pushing up the diaphragm against the heart and lungs, it interferes with their action and consequently may cause death. In peritonitis, it is a very grave symptom, signifying the loss, or the partial loss, of the peristaltic action of the intestine.

Voice

Hoarseness denotes congestion of the vocal cords or larynx; loss of voice—aphonia—may be due to hysteria, prolonged use of the voice, inflammation or cicatricial lesions of the larynx, paralysis of the vocal cords or of the laryngeal nerve, obstruction in the larynx due to foreign bodies, tumors, etc.

Physical Signs

As stated in the first part of the chapter, some abnormal conditions are discoverable only by auscultation, palpation, and percussion.

By auscultation is meant the act of listening for sounds within the body. It is used chiefly for ascertaining the condition of the pleura, lungs, heart, and blood-vessels and for the detection of pregnancy. Auscultation may be performed by the aid of an instrument called the *stethoscope* or by applying the ear directly upon the body. Many of the abnormal sounds heard in the lungs are spoken of as *râles*, so called from a French word meaning rattle. A few of the terms used in describing these râles and the conditions producing them are as follows[1]: Dry râles,—these are produced by the presence of viscid secretion in the bronchial tubes or by thickening of the walls of the tubes; Moist râles,—those produced by the presence of liquid in the bronchial tubes; Crepitant râles,—a crackling sound heard at the end of inspiration in the early stages of croupous pneumonia; Subcrepi-

[1] It is, of course, not necessary for nurses to learn to distinguish these sounds, nor to make such examinations. They are mentioned here simply as a matter of interest.

tant râles,—fine, moist râles heard in conditions associated with fluid in the smaller tubes as in edema of the lungs; Mucous râles,—a modified subcrepitant râle caused by the bursting of viscid bubbles in the bronchial tubes.

Murmur is the term applied to various sounds that show abnormal conditions in the heart, blood-vessels, and blood.

What are known as *friction sounds* are produced by inflammatory conditions of the pericardium and pleura. They are caused by the roughened serous membranes rubbing against each other.

By palpation it can be ascertained if such organs as the liver, spleen, and bladder are in their natural position; if the bladder is distended, if abnormal growths are present, etc.

Percussion produces certain sounds and sensations by which the thickness of underlying structures, elasticity of the tissues, presence of fluid, etc., can be determined.

Physical Examination

Usually, soon after a patient is admitted to the hospital, a doctor makes a more or less thorough physical examination, using the methods just described to ascertain the patient's general physical condition.

Requirements for Examinations.—Some important points to remember in preparing the patient for examination and in assisting the doctor are: To expose the patient as little as possible, to be quick, to have everything that the doctor will require at hand. In some hospitals, an enamel basket containing every-

thing likely to be needed is taken to the bedside. The contents of the basket are:

(1) A mirror for examination of the throat.

(2) Tongue depressors—wooden.

(3) Small paper bags. An opened one is always standing in a corner of the basket ready to receive a tongue depressor after use.

(4) A towel.

(5) An auscultating towel.

(6) A tape measure.

The *doctor's order book* is taken to the bedside with the basket, as, after finishing the examination, he is likely to wish to write his *orders* for the patient's treatment.

To Prepare a Patient for a General Physical Examination.—Put screens around the bed; loosen the top covers at the foot of the bed; fold the spread back under the blankets so that these can be folded up quickly when required, without disturbing the sheet; gather the middle portion of the lower part of the sheet in between the thighs and legs, leaving its sides covering these parts. Take the arms out of the nightgown, but leave it covering the arms and chest until the doctor is ready.

Examination of the Chest.—When the doctor uses the stethoscope, move the nightgown as he requires; when he wishes to listen to the chest sounds without the aid of the stethoscope, replace the nightgown with the auscultating towel, hold the hand towel or a corner of the auscultating towel in front of, but away from, the patient's mouth. If the patient sits up in bed for examination of the posterior chest, button the nightgown around her neck so that her anterior chest will be covered and draw a pillow down

against the lower part of her back. When using the auscultating towel, be sure to put the same side on the patient that was against her previously.

For Examination of the Abdomen.—Cover the chest with the nightgown, and, if the air is cold, with a nightingale; fold the covers down just below the abdomen; have no more exposure than necessary. The doctor usually wants the patient's knees flexed.

For Examination of the Legs.—Fold up the upper covers, except the sheet, to the upper part of the thigh. The side edges of the sheet, it will be remembered, are covering the legs. Move these as much as required. When the doctor wishes to use the knee jerk test, cover the leg not being tested with the sheet, and also as much of the other thigh as possible. Draw the free side edge of the sheet under the leg to be tested, so that when the knee is flexed there will be no exposure, except of the leg and knee.[1]

Various methods of preparing a patient for vaginal and rectal examination will be found in the chapter devoted to gynecological treatment. The methods of holding a child for examination have been already discussed—see page 178.

Charting

In the majority of hospitals, a separate record, or chart, is kept for each patient. On this should be recorded her temperature, pulse, and respiration, and all the treatment and medication given her, with the

[1] Tapping the knee and observation of the extent of the jerk elicited is one of the means used by the physician in judging of the condition of the central nervous system, certain abnormal conditions of the spinal cord diminishing or abolishing the jerk, other conditions of the cord and also certain cerebral lesions increasing it.

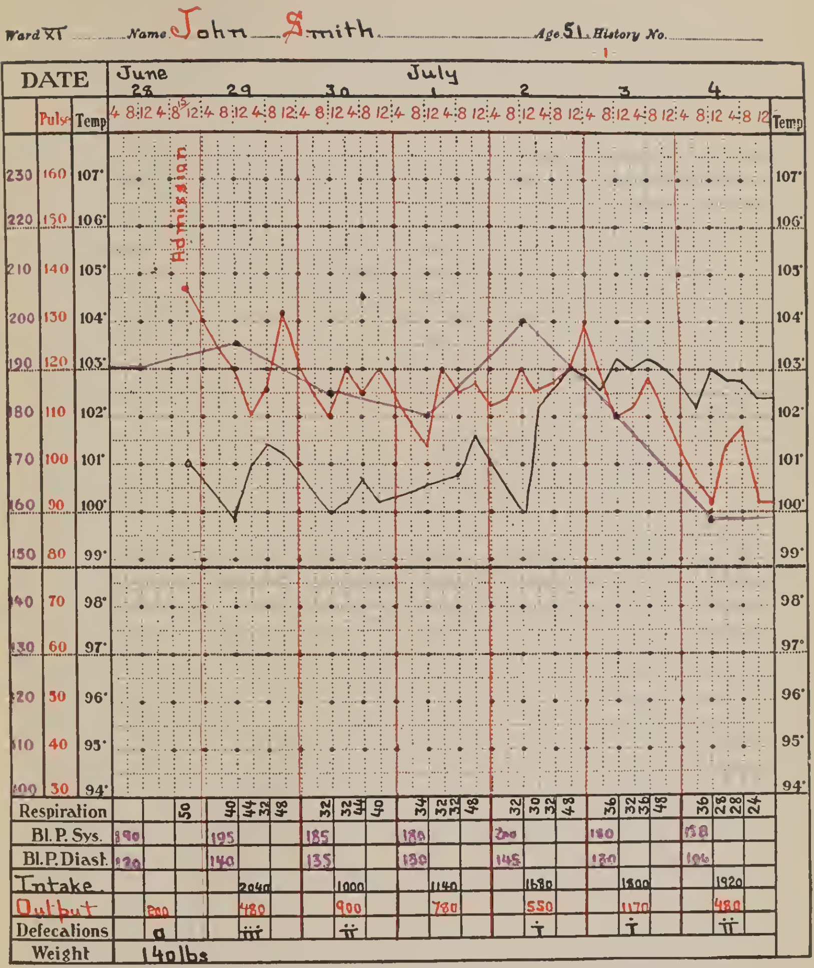

FIG. 16.—CHART. THE BLACK LINE INDICATES THE TEMPERATURE; THE RED, THE PULSE; THE PURPLE, THE BLOOD PRESSURE

result of the same. Thus: If a patient is given a narcotic, state whether or not she slept; if so, how long, and how soon after taking the medicine. When stimulation is given, mention the effect upon the pulse; a few days after starting a tonic, and periodically afterward, make some remark about the appetite, never failing to report any abnormality. When a patient is on a liquid diet, or when, as is the case in a great many diseases, the amount of liquid taken is a matter of importance, measure and chart it accurately.

All symptoms, whether subjective or objective, should be recorded. The frequency, and, with a very sick patient, the character, of each bowel movement. The urine should be measured and the result and time of voiding recorded in the following cases: In all kidney and heart diseases; for the first twenty-four hours after a patient's admission to the hospital; after an operation; whenever there is any suspicion of the passing of an abnormal amount; when it is necessary to catheterize; in fact, whenever there is an abnormality of any description in the character of the urine or in the voiding of it. When urine is voided involuntarily, the average amount should be estimated.

Catamenia, and any attendant abnormality, such as menorrhagia or dysmenorrhea, should also be recorded.

Charting should be done neatly and distinctly. To avoid wasting paper and making the record too bulky, employ small characters. It is customary in many hospitals to use printed, rather than written, letters, as greater legibility and uniformity can thus be secured. To recapitulate, everything of any importance must be mentioned, but as clearly and concisely as possible, not using a single unnecessary word.

CHAPTER IX

SYMPTOMS (*Continued*)

The Necessary Observation of Sputum, Vomitus, Feces, and Urine. The Characteristics of Normal Feces and Urine. The Symptoms which Abnormal Conditions in Feces and Urine and Various Types of Sputum and Vomitus Indicate. The Collection and Care of Specimens. Methods of Testing Urine for Albumin, Glucose, Indican, and Pus. How to Take the Specific Gravity and Reaction of Urine.

THE condition of sputum and vomitus and of feces and urine often gives valuable information regarding a patient's condition. Therefore, such materials should always be carefully observed, and if they present an unusual appearance, kept for the physician's inspection.

The Collection of Specimens

Usually, it is better to keep sputum, vomitus, or feces for inspection in the vessel in which it has been received and the vessel should be covered and kept in as cool a place as possible. When a specimen is to be sent to the laboratory, unless otherwise stated, a small amount is all that is required. The utensil used for a specimen must be sterilized or, at least, thoroughly washed with hot water before the substance is poured into it; it must be tightly covered and

properly labeled. Special points in regard to urine specimens will be found on page 244. To obtain a specimen of sputum from a child, who cannot be made to expectorate, touch the back of its throat with a swab. This usually induces a reflex cough, and if, as is likely to happen, sputum is expelled, it will be caught by the pledget.

Sputum

The sputum should be studied with particular care in all lung and bronchial diseases, for its condition in such disorders is not only of diagnostic value, but also affords valuable information regarding the progress of the disease. This is especially the case in pneumonia, in which ailment, as will be seen in Chapter XXV., there are typical conditions in the sputum at the various stages of the disease.

The points to be noted about sputum are its color, consistency, odor, and quantity. The terms used in describing the character of the sputum and the significance of the conditions are as follows:

1. **Fetid sputum,** so called from its offensive odor, is characteristic of gangrene and abscess of the lung.

2. **Mucoid sputum,** *i. e.*, mucus-like sputum, is characteristic of asthma, bronchitis, the early stages of pneumonia and tuberculosis, and of pulmonary edema. In the latter disease, the sputum is also very watery and frothy.

3. **Muco-purulent sputum**—this form of sputum is so called because it contains mucus and pus; it is common in chronic catarrhal affections of the lungs and bronchi, convalescent pneumonia, and phthisis.

4. **Nummular sputum**—this is the name applied to

round coin-shaped masses of sputum which sink in water. Nummular sputum is characteristic of advanced tuberculosis.

5. **Purulent sputum**—this term is applied to sputum consisting of, or containing, pus; it is observed principally in abscess of the lung or when an empyema ruptures into the lung.

6. **Prune-juice sputum**—this is sputum containing blood that has been altered so as to resemble prune-juice. It results from retention of blood in the lung, and occurs in severe cases of pneumonia, and in gangrene and cancer of the lung.

7. **Rusty sputum,** so called because the streaks of blood give it a rusty color; this is characteristic of pneumonia.

8. **Red-currant-jelly sputum** is the name given to sputum that on account of the blood and disintegrated tissue it contains looks somewhat like red jelly. It is more or less characteristic of cancer of the lung.

9. **Sputum containing fibrous shreds** is common in membranous croup and diphtheria.

Vomiting and Vomitus

The points to be noted and recorded concerning vomitus and the act of vomiting or emesis are: The character of the vomitus, the frequency of vomiting, whether vomiting relieves nausea, pain, etc., and, sometimes, the manner of vomiting. By character of the vomitus is meant its color, odor, and consistency. Some of the more common distinctive characteristics of vomitus are:

Bilious or green vomit; the color, as the name

implies, is due to the presence of bile. This kind of vomitus is not characteristic of any particular abnormal condition. It may occur in any case in which vomiting persists after the stomach has been emptied of food. It is especially common after the taking of anesthetics.

Dark brown-green vomitus with an acid reaction is often noted in peritonitis.

Blood in the vomitus, when present in large amounts, can be recognized by the unaided eye, but small quantities are sometimes only detected with the aid of a microscope or by chemical tests. If the blood remains in the stomach for any length of time after it is shed, it will undergo partial digestion and will resemble coffee grounds. Some of the more important causes of hemorrhage from the stomach—hematemesis—are: Gastric ulcer, cancer, severe gastritis, scurvy, traumatism, vicarious menstruation. Vomited blood may also be from a ruptured aneurism or from the lungs, mouth, or throat. Blood from the lungs has a more or less frothy appearance due to the presence in it of air.

Fecal vomit indicates intestinal obstruction or a gastro-colic fistula due to ulcer or cancer of the stomach. The nature of the vomitus is recognized by its odor.

Purulent vomitus, *i. e.*, vomit containing pus, may result from the rupture of an abscess into the stomach or from severe gastritis.

Watery or mucous vomit is common in chronic gastritis, some forms of nervous dyspepsia, brain disease, and often persistent vomiting.

Profuse vomiting of large quantities of fermented frothing matter is indicative of gastric dilation.

The points to be noted regarding the manner of vomiting are:

1. **If the vomitus is ejected with force.** This occurs most frequently in brain diseases and in advanced stages of peritonitis.

2. **If the vomiting occurs without retching or distress;** this is often the case in the vomiting of pregnancy, in hysteria, in certain neuroses of the stomach, in uremia, and in some cerebral disorders.

3. **If food is regurgitated;** *e. g.*, due to paralysis of the muscles of deglutition or obstruction in the pharynx or esophagus, the food may not reach the stomach, but be returned or regurgitated at once. The term regurgitation is used also to express the casting up of undigested food without retching or apparent nausea. This happens very frequently in infants who are given more milk than their stomachs can hold, and in any of the conditions mentioned in the preceding paragraph.

Causes of Vomiting. Vomiting may be due to (1) local irritation in the stomach resulting from disease of the organ or from the presence of irritating substances as drugs or irritating foods; (2) it may be due to nervous affections as hysteria, neurasthenia, and migraine; or (3) to irritation of the central nervous system by certain emetics or by toxic substances of any kind, *e. g.*, overdoses of poisonous drugs, poisons developed within the body either as the result of bacterial activity or of abnormal metabolism, as in diabetes and uremia, or of defective elimination as in nephritis and constipation. The irritation of the central nervous system may be caused also by disease of, or pressure upon, the brain or cord, or it may be of reflex origin as from pregnancy, uterine or ovarian

disease, irritation of the fauces, worms, biliary colic, etc.

When Vomiting Is a Favorable Symptom.—It is a favorable symptom if a patient suffering from shock vomits, for it shows that the reflex centers are recovering from their depression.

Feces

The character of the feces being an index of the condition and functioning capability of the digestive organs, all evacuations of the sick and of infants should be carefully examined. This should be done in a good light, since it is often difficult to detect foreign matter, and when examining stools for worms, calculi, etc., it is well to tie thin muslin over a chamber or specimen vessel. Empty the bed-pan into this and pour water over the feces slowly, breaking up all lumps with a stick.

Necessary Observation of Stools.—The principal items to be observed in regard to stools are: (1) Their consistency, (2) their shape, (3) their color, (4) their odor, (5) the presence or absence in them of unusual matter, (6) the number of movements in the twenty-four hours.

Normal Condition of Stools.—The normal stools of individuals on ordinary diet are usually a light or dark brown, more or less formed, but soft, mass of cylindrical shape. The normal evacuation of the new-born infant is an odorless, sticky, thick-liquid, brown substance known as *meconium*. The stools of breast-fed infants are of a yellow or orange tint, of semi-solid consistency and of slightly acid reaction. The stools of infants artificially fed are

lighter in color and bulkier in mass than those of the breast-fed baby.

Changes that occur in the consistency of stools are: (1) They may be abnormally hard—this indicates constipation, the hardness being due to the absorption of an unusual amount of water from the residual matter on account of its prolonged stay in the intestines. (2) Stools may be abnormally soft. This is generally the result of unusually rapid passage through the intestine in consequence of which the usual amount of absorption of water does not take place. This rapidity of passage through the intestine is the result of increased peristaltic action of the bowel and this may be caused by cathartic medicines, irritating food, too much food, disease of the bowel, the presence of foreign substance—as worms—in the intestine, or nervousness. Except when this condition of the stools is due to medicine, it is likely to be associated with the passage of an abnormally large number of stools in the twenty-four hours and the condition is known as *diarrhea*. If the diarrhea is very severe or if it is continued for any length of time, the stools become of a watery consistency, and may contain little fecal matter, but considerable blood or mucus. This is the condition in Asiatic cholera, in enteritis, dysentery, and cholera infantum. Watery stools are also caused by hydragogue cathartics and by poisonous doses of corrosive drugs.

Change of shape in formed stools is to be noted because stools are made flat or of very small diameter as the result of the presence of a tumor or other obstruction in the intestine.

The principal important changes that occur in the color of stools are: (1) Black stools; this color may

be due to the use of such drugs as bismuth, charcoal, iron, tannin, or to hemorrhage into the stomach or small intestine, the blackness of the stool in the latter case being due to the blood having been retained in the intestine for some time and, while there, digested. (2) Green stools, which may result from the presence of bile in unduly large proportion or, especially in children, from defective digestion or fermentation due to bacterial action. (3) Greenish-yellow evacuations; these, when of a liquid-pea-soup consistency, are characteristic of typhoid. (4) Red discoloration of the stools, unless the patient has been given hematoxylon (logwood), indicates the presence of freshly shed blood.

The foreign substances more commonly found in defecations are: Blood, fat, gall-stones, mucus, pus, undigested food, undigestible substances, as fruit stones, etc., worms.

Blood that is passed from the intestine as soon as shed, as usually happens when it is the result of hemorrhage in the large intestine, or from piles or fissures, will be bright red, but blood that is retained in the intestine for any length of time, as often occurs when the hemorrhage is from the stomach or small intestine, is more or less black or tarry-looking. The more common causes of blood in the stools are: Inflammatory conditions of the intestine, ulceration, as in typhoid, ulcers of the stomach, intestine, liver, or pancreas; rupture of an aneurism; piles, fissures, fistula. When the patient is a woman, it is necessary to be sure that the blood was discharged with the feces and not in the urine or from the uterus.

Fat in the stools may be due to: (1) eating large

quantities of fat, (2) lack of bile, or (3) chronic pancreatic disease.

Mucus is usually due to an irritated condition of the intestine. When the trouble is in the lower bowel the mucus is usually passed in flakes; when it is the upper part of the intestine that is affected, the mucus is generally mixed with the feces.

Pus is generally present as the result of the rupture of an abscess into the intestine or from a fistula in ano.

Undigested food may be present in the feces as the result of eating too much food or of a diet including a large proportion of food that is not easily digested, but its presence may indicate diseased conditions of the stomach or small intestine. In the last case other symptoms, as diarrhea and the presence of blood or mucus, will be present. The evacuations of infants should be examined frequently for signs of undigested food, as its presence is often one of the first symptoms that the child's food is not such as it can digest. In infancy, while a child is fed exclusively with milk, the undigested matter will be either curded caseinogen or fat. True curds are not found in babies fed on human milk. Curds in the stools indicate either (1) too much protein substance, (2) impure milk, (3) gastric derangement. The reasons for the presence of fat in the stools have been already stated. If the error in the diet is not corrected, the stools will soon become greasy-looking and will smell sour.

The worms most frequently found in the feces are the *Oxyuris vermicularis*, the thread- or seat-worm (a fine white worm $\frac{1}{5}$ to $\frac{2}{5}$ of an inch in length), and the *cestodes* or tapeworm (a long flat worm, pieces of

which are often mistaken for shreds of mucus). In examining a tapeworm, always see if the head has been expelled, as, otherwise, the worm will grow again.

The more common causes for changes in the odor of feces are: Lack of bile, excessive intestinal putrefaction, diseased conditions of the intestines.

The normal number of stools for people on regular diet are one or two a day; for babies fed on human milk, five to six a day; babies fed artificially have, usually, fewer, but larger, defecations.

Urine

Composition of Urine.—Urine consists of water, holding in solution certain organic substances—*e. g.*, urea, urates, creatin, creatinin, xanthin, etc., which are waste products of the protein substances of food and of body tissue,—salts, and pigments. Also there may be, even in health, various other matter present derived from unusual articles of food or from drugs that have been taken into the system. In diseased conditions, especially those involving the kidneys and in disturbances of metabolism, other substances, which will be described later, may be present. Therefore, the condition of the urine is often of value in determining the nature and progress of a disease, even when it does not affect the urinary system, and careful inspection of the urine during illness is very important.

Points to be Noted.—The principal points for nurses to note in regard to urine are: the amount voided in twenty-four hours; the color, clearness, and odor of the urine. Occasionally in private nursing

or in small hospitals they may be asked to take the specific gravity and to make a few simple tests which will be described later.

In order to distinguish abnormal conditions in the urine it is necessary to know what the normal ones are; therefore, before describing conditions produced by disease, we will consider the nature of normal urine and of the substances contained in it.

QUANTITY.—The average amount of urine voided in twenty-four hours by a healthy adult is about 40 to 50 ounces; by a child of

2 to 5 years, 15 to 25 ounces.
5 to 9 years, 25 to 35 ounces.
9 to 14 years, 35 to 40 ounces.

Causes likely to diminish the quantity of urine are: the consumption of a small amount of liquids, free perspiration, high fever, diarrhea, vomiting, and disease.

Causes likely to increase the quantity of urine are: the ingestion of a large amount of liquids; nervousness; the action of diuretics; certain diseases, more especially diabetes mellitus, diabetes insipidus, and hysteria.

PHYSICAL PROPERTIES.—Normal urine is a transparent, yellowish or light amber-colored liquid, with a characteristic odor, a slightly acid reaction, and a specific gravity of 1012 to 1030, 1020 being the average.

SPECIFIC GRAVITY.—By specific gravity is meant the weight of the urine as compared with distilled water at 60° F., the weight of the water being 1000. The specific gravity indicates the relative proportion of solid matter in the urine and when it is much increased the presence of abnormal constituents is

often suspected, but an increase or decrease in the amount of urine, even from normal causes, will influence the specific gravity, since it will be lower if a large amount of water is secreted by the kidneys and higher if the urine is less dilute.

Causes of Change of Color in Urine.—The conditions causing variations in the quantity of urine are also likely to change its color. When its secretion is diminished, the urine is generally highly colored, the amount of solids present being comparatively large. When its secretion is abnormally increased, the urine is usually of a pale straw color, except when the increase is due to diabetes mellitus, in which case the color is darker, owing to the presence of sugar. Other causes of changes of color are decomposition of the solid constituents of the urine, the presence of abnormal substances, overdosing by certain drugs, as iodoform, salol, guaiacol, carbolic; and, sometimes, in a disease known as *filariasis*, the color is changed to a whitish hue from the presence in it of chyle. This condition of the urine is spoken of as *chyluria*. The reasons for the presence of the chyle in the urine will be found in the paragraph describing the disease in Chapter XXV.

Transparency.—As previously stated, normal urine is transparent, and lack of clearness is very likely to be due to the presence of abnormal substances or of normal constituents in abnormally large amounts.

Odor.—Normal urine when first voided has, usually, a slight characteristic odor due to the presence of hippuric acid and other aromatic substances, but if the urine is kept after being passed the odor becomes ammoniacal owing to the decomposition of its protein

constituents into ammonia and allied substances. If the urine has an odor of ammonia when first passed, it shows that it has decomposed within the bladder. This often happens when a patient has cystitis.

Reaction.—The acid reaction which is characteristic of the urine of the majority of human beings is due to the quantity of foods they eat the waste products of which are acid. After a diet consisting solely of carbohydrates, the urine will be alkaline, as is the urine of herbivorous animals, because the ash of the majority of plant foods contains a large per cent. of alkaline substances. If human urine is allowed to stand for any length of time after being voided, it will, unless it is kept sterile, become alkaline, because the bacteria which gain entrance will break up its protein constituents into ammonia and other alkaline substances. This same kind of decomposition may take place within the body in certain diseased conditions of the urinary organs, and under such circumstances, the urine will be alkaline when voided.

Nature of Normal Constituents of Urine

Urea.—Urea, which constitutes nearly one half of the total quantity of the solid substances of urine, is formed in the body, largely in the liver, by the oxidation of protein substances derived from food and, to some extent, from body tissue. Normally, an adult voids between 20 and 30 grams (about one ounce) daily, but, the quantity will be increased by a diet containing a large amount of protein food, strenuous exercise, hot baths, fever in its early stages, and in a few diseases; and it will be diminished when only a small amount of protein food is eaten, by free

perspiration, excessive vomiting, diarrhea, and a few diseases, especially those which involve the kidneys. Formerly, it was thought that urea was a very poisonous substance and that its retention in the body was the cause of a very fatal disease, which often complicates abnormal conditions of the kidneys, hence the disease was named *uremia*. But experiments have shown that urea by itself is not actually poisonous. See paragraphs on uremia in Chapter XXV.

Uric Acid.—This, next to urea, is the medium by which the largest quantity of nitrogen is excreted from the body. It is thought that it is formed in the tissues, especially in the liver, by the oxidation of the nuclei of cells. Uric acid, when pure, is colorless, but it is not usually found in its free state in normal urine, but in combination with potassium, sodium, ammonium, etc. Such combinations are known as urates. The reddish deposit often seen in urine, after standing, is due, as a rule, to these urates.

The quantity of urates in the urine is increased by conditions that cause increased metabolism, as exercise, fever, etc., and in certain diseases. When changing a child's diaper, always notice if the urine leaves a reddish stain, as such a stain may be due to a deposit of urates, and this, in a child, often indicates faulty metabolism.

Creatin, Xanthin, etc.—These substances represent the so-called extractives of meat, and are therefore taken into the body with the food as well as formed in the tissues by the oxidation of protein substances.

Salts.—The salts eliminated in the urine are derived both from food and as products of metabolism; *e. g.*, acids are being constantly formed in the

tissues as the result of oxidation of body tissue and of food substances absorbed from the intestines and carried to the tissues by the blood. These acids unite with alkaline substances, also brought to the tissues by the blood, and the combined acids and alkalies form salts. When metabolism is defective a greater amount of acid is formed in the tissues and consequently the kind and quantity of salts in the urine may be different from those found in health.

Abnormal Constituents of Urine

Some of the more important abnormal substances found in urine are albumin, glucose, acetone, indican, casts, calculi, pus, mucus, blood.

Albumin.—As a rule, the normal renal cells do not allow albumin to pass from the blood, but, occasionally, as after extreme muscular exertion or overeating, they will. Albumin in the urine from such causes is spoken of as *temporary* or *functional albuminuria*. Loss of albumin occurs also in certain diseases from various causes; *e. g.*, it occurs in heart disease in consequence of abnormal pressure changes in the renal blood-vessels, as the result of the damaged pump—the heart. It is usually, but not always, found in the urine of those suffering with nephritis, and it is very frequently present in the urine in cases of acute fever in consequence of an abnormal condition of the kidneys due to the disease.

Glucose.—The blood, in health, maintains a constant per cent. of glucose, about 0.1 to 0.15 per cent. More than this would be injurious to the tissues, therefore, when a larger quantity of sugar is eaten—*e. g.* candy—than the system can at the time

change to glycogen or fat, the kidneys secrete and excrete it as quickly as possible. When glucose is found in the urine from the above cause, it is called *temporary glycosuria.* Temporary glycosuria sometimes occurs also after injury to the head, during convalescence from febrile diseases, etc. In such cases, the abnormal amount of sugar in the urine may be due to an inability of the system to oxidize the glucose, but the condition is relieved as convalescence is established. When glucose persists in the urine, the patient is said to have diabetes mellitus. One cause of this is disease of the pancreas, which interferes with the secreting of the internal pancreatic secretion, one of the activating causes of the oxidation of the glucose in the tissues. In mild cases of diabetes, the condition can be controlled by lessening the amount of carbohydrate food. In very severe cases, glucose will appear in the urine when the diet is entirely free from carbohydrates, even in starvation, because the body tissues will be oxidized and glucose can be formed from protein substances.

ACETONE.—Acetone is a volatile compound sometimes found in the urine of individuals suffering from diseases associated with defective metabolism and in normal persons during continued fasting. It is thought to be the result of the incomplete oxidation of fats and, some authorities consider, of proteins.

INDICAN.—The putrefaction of protein material in the large intestine gives rise to a substance known as indol. This, after absorption, is changed, it is thought in the liver, into indican, a less poisonous substance than the former. Traces of indican are found in normal urine, but abnormal conditions are indicated if it is present in any amount. The more common

causes of an increase in quantity are: (1) Excessive putrefaction of protein substances in the intestine. This is usually due either to a diseased condition of the intestine, which interferes with the absorption of the normal products of digestion, or to constipation. (2) A diet containing too much protein food. (3) Diseases of the stomach, as the result of which food lies in that organ a long time and undergoes fermentative changes.

Nature of Casts.—In certain abnormal conditions of the kidneys, the renal tubules become partially filled with substances which harden, thus forming moulds or casts of the tubes. These casts vary in shape and appearance, and are known by different names, such as granular casts, fatty casts, etc. They are washed from the tubules by the urine and can be discovered therein with the aid of a microscope.

Urinary Calculi or Stones.—These consist of deposits of solid matter that have been precipitated from the urine. They may form in any part of the urinary tract, from the tubules of the kidneys to the meatus urinarius. The most frequent causes of their formation are: (1) changes in the reaction of the urine, abnormally acid and abnormally alkaline urine tending alike to produce calculi; (2) the secretion of a small amount of water; (3) an increase in the less soluble constituents of the urine. Calculi vary in size, shape, and composition; the size and shape depending largely upon their composition and location.

Pus.—Pus cells are always present in the urine in nephritis and other inflammatory conditions, either of the kidneys or other organs of the urinary system.

Mucus.—Mucus may be present in normal urine in small quantities; it consists principally of the

epithelial débris from the mucous surface of the urinary organs. In inflammatory conditions of these organs, especially of the bladder, mucus is poured out over their surface and, therefore, appears in large quantities in the urine.

Blood.—Blood corpuscles are often found in the urine in cases of acute inflammation of any of the urinary organs, of tuberculosis, of cancer, and of renal stone or calculi. When there are many corpuscles present, the color of the urine is affected; it may even look like blood. When this is the case, the condition is known as *hematuria*.

The Collection and Care of Urine Specimens for Analysis

It is a rule in many hospitals that a specimen of urine from every new patient be sent to the laboratory the morning after admission to the hospital and the morning before and after operation.

Reasons for Specimens.—The reasons for the specimen upon admission are: (1) Diseases of the kidneys often complicate other maladies and recovery from the renal disturbance may depend upon its early recognition and treatment; (2) the condition of the urine frequently gives the diagnostician a valuable clue to the nature or progress of the patient's disease. The reasons for the specimen before operation are: (1) General anesthetics, especially ether, are very irritating to the kidneys, and if kidney disease exists, it may be better to omit the operation, at any rate until the kidney disturbance is better. (2) Unless it is absolutely necessary, anesthetics are never given to diabetic patients because: (1) they are likely to in-

crease the abnormal conditions already existing; (2) when a patient's blood is surcharged with sugar, wounds take a long time to heal and dangerous complications are likely to occur. The post-operative specimen is required in order to ascertain if the anesthetic has had any undesirable influence upon the kidneys.

Collections of Specimens.—Before pouring urine into a specimen glass, wash the latter with hot water, even though it appears clean. Unless otherwise ordered, four or five ounces of urine is usually all that is required. Cover the glass by tying a piece of clean paper over it, and attach a label on which you have written the date, the name of the patient, the ward, the hour at which the specimen was obtained, and the reason for taking it; that is, whether after the admission of the patient, before or after an operation, or for a special examination.

Sometimes, the whole amount of urine voided during the twenty-four hours is required. In this case, note the hour the first time the patient voids urine. Throw away that urine, but save all that she passes subsequently until the same hour the next day. A five-pint glass bottle is a convenient receptacle for urine thus collected. The bottle must be sterilized, it must stand in a cool place, and must be kept tightly corked with sterile cotton, otherwise decomposition will begin before the end of the twenty-four hours. A few drops, two or three, of formalin, thymol, or chloroform are usually put in the bottle, because these antiseptics will retard the decomposition of the urine, but will not cause any changes in it that will interfere with obtaining a correct analysis.

If a sterile specimen is required, use a urinal,

rather than a bed-pan, to catch the urine and sterilize this as well as the bottle. A woman patient will have to be catheterized.

When a specimen from a male infant is desired, bandage a small slim bottle in position to catch the urine when voided, and adjust the diaper firmly so that it will assist in holding the bottle in place. To secure a specimen from a girl baby, lay the infant on two pillows with the pillows slightly apart under the buttocks and place a bedpan in the opening, its edges being under the pillows and the ends of the pillows protected with rubbers.

Urinalysis

Foreign substances are detected in urine by boiling, by means of chemical tests, and with the help of the microscope. The testing of urine does not really belong to the nurse's province, but occasions sometimes arise in which a knowledge of the tests for albumin, glucose, indican, and pus is of value. Also, it is well to understand how to take the specific gravity of urine, and how to test its reaction.

Heat Test for Albumin.—To test for albumin: First, filter the urine. Then, fill a test-tube to one third of its depth, and, if the urine is not acid, render it so by adding two or three drops of 10 per cent. acetic acid. Finally, boil it for a minute, holding the test-tube so that the upper part of the urine will boil first. Any opacity appearing will be due either to albumin or to earthy phosphates; to discover which, add two or three drops of acetic or nitric acid. If it is due to the latter, it will disappear on the addition of acid; but if to the former, the presence of the acid will cause the albumin to be further precipitated.

Fehling's Test for Glucose.—The solutions used for this test are (1) a solution of copper sulphate, (2) an alkaline solution of Rochelle salt. Take about two drams of each of these solutions in a test-tube and boil. If the solution remains clear, add 20 or 30 drops of the urine to be tested. If much glucose be present, a yellow or red precipitate readily appears, but if the quantity of sugar is small, the precipitate will not appear for some time, therefore the test should be allowed to stand for from 18 to 24 hours.

The reaction that takes place in this test is called *reduction; i. e.*, the taking away of oxygen from a substance. The glucose, when present, takes some of the oxygen away from the copper sulphate, and thus forms the red, insoluble substance, known as *cuprous oxide*, which, being insoluble, precipitates.

There are certain important points to remember in connection with this test:

(1) If the urine contains albumin, this must be reremoved before testing for glucose, because even a trace will interfere with the reduction of the copper. To remove, boil the urine and then strain it.

(2) Always boil the solution used for testing, because, being easily decomposed, it may be useless. The reagent is unfit for use if it loses its clear blue color on boiling. If a too concentrated solution of copper is used, the reagent may turn yellow or green when heated.

(3) The mixed reagent and urine should not be heated, because certain substances in the urine, as uric acid, hippuric acid, etc., will, in the presence of heat, reduce the copper sulphate.

Test for Indican.—Pour 15 c.c. of strong hydrochloric acid into a test-tube, add one or two drops of

strong nitric acid, add 30 drops of the urine to be tested, and stir at once. The development of an indigo blue color shows the presence of indican and the amount can be estimated by the depth of shade. When there is no more indican present than is compatible with health, the shade is a light amethyst.

The color reaction that takes place is due to the decomposition of the indican by the hydrochloric acid.

Test for Pus.—When pus and mucus are present in the urine, they will, when the urine stands, settle at the bottom of the glass. Before testing the urine, carefully pour off as much of the overlying liquid as possible; then pour some ammonia or a strong solution of potassium or sodium hydrate on the sediment. If this consists of pus, it will be converted into a thick, viscid, gelatinous mass; if of mucus, it may be curded, but it will not be formed into a viscid mass like the pus.

To Test the Specific Gravity of Urine.—Fill the urinometer-glass three quarters full of urine; put in the urinometer, making it touch the bottom of the glass; then release it and wait until it stops changing its level. When it comes to a rest, read the degree scale through the fluid from below upward, the last mark seen below the surface of the liquid being the correct specific gravity.

Nature of Indicators Used for Testing Reaction of Urine.—It has been found that acids and alkalies change the color of certain substances in different ways. Such substances can, therefore, be used to determine the reaction of urine. They are called *indicators*. The indicators in more common use are: Litmus, a liquid obtained from a small

lichen; methyl orange, a coal-tar compound; tumeric, a solution obtained from a tropical plant; phenolphthalein, a coal-tar product.

Action of Acids and Alkalies.—Acids turn blue litmus and yellow methyl orange, red. Alkalies turn red litmus blue; red methyl orange, yellow; yellow turmeric, red; a clear solution of phenolphthalein, pink.

Before closing the discussion of symptoms connected with urine, three abnormal conditions, that sometimes occur and which it is very important to recognize, must be mentioned. These are suppression, retention, and retention with overflow.

Suppression and Anuria.—Suppression and anuria are terms applied to cases in which the kidneys fail to secrete urine. Anuria is highly dangerous to life, as toxic poisoning will ensue, unless it is quickly relieved.

Retention.—In retention, the urine is secreted by the kidneys; but, owing to some obstruction in the urethra or neck of the bladder, paralysis of the bladder, nervous contraction of the urethra, or dulling of the senses so that there is no desire to pass urine, it is not expelled from the bladder.

Retention with Overflow.—By retention with overflow is meant over-distention of the bladder in conjunction with either incontinence or the constant voiding of small quantities of urine. Other symptoms are pain and the emission of a dull sound when percussion is applied over the bladder. If there is much distention, the outline of the bladder can usually be distinctly felt. Such a condition should always be reported to the doctor.

CHAPTER X

SYMPTOMS (*Concluded*): TEMPERATURE, PULSE, RESPIRATION

Source, Loss, and Regulation of Heat. The Normal Temperaure. Diurnal Variations of Temperature. Reasons for Death, from High Temperature. Fever as a Protective Measure. Causes, Stages, and Types of Fever. The Nature and Care of Thermometers. How to Take the Temperature. The Pulse —What it Is and Where it can be Felt. Points to Observe when Counting the Pulse. How to Count the Pulse. Normal and Abnormal Characteristics of the Pulse and Conditions which Give Rise to the Latter. The Respiration—Its Purpose, Nature, and Mechanism. Normal and Abnormal Characteristics of the Mechanism of Respiration, and Causes.

NO symptoms are more significant than those which have to do with temperature, pulse, and respiration.

Temperature

Definition.—Temperature may be defined as the degree of hotness of a body measured according to some chosen scale.

Source of Heat.—Heat is produced in the animal body in all the living tissues, but more especially in the muscles and secretory glands, as the result of chemical changes (especially those associated with

oxidation[1]) which take place in the substances brought by the blood from the alimentary canal and deposited in, and sometimes built up into, the various tissues of the body. Minor causes of heat are friction—*e. g.*, the friction caused by the movements of muscles, circulation of the blood, etc., and the ingestion of warm food.

DISTRIBUTION OF HEAT.—As stated in the preceding paragraph, heat is produced to a much greater extent in some organs than others; nevertheless, the temperature of the interior of the body is almost uniform. This is because the blood is constantly flowing from the parts where heat is more especially generated to more superficial and cooler parts, and the cooler blood is as constantly flowing from the cooler parts to those in which heat production is occurring most rapidly.

LOSS OF HEAT.—Though heat is being constantly generated in the body, the body temperature, in health, usually remains between 98° and 99° F. This is because there is an equally constant loss of heat. This loss is effected in several ways: (1) By radiation and conduction from the external surface of the body; (2) by the constant evaporation[2] of water from the same part; (3) by taking into the lungs colder air than that given out; (4) by the ingestion of cold food and drink. The comparative degree of effectiveness of

[1] By oxidation is meant the union of oxygen with a substance. When oxidation takes place, the substance breaks up into its constituent parts and heat results. When oxidation takes place very quickly, not only heat, but light, is generated. It is then called combustion.

[2] Heat is required for the evaporation of water, about 0.5 calories for each gram of water that is evaporated, and that necessary for the evaporation of sweat is taken from the body. This is why there is a loss of heat as the result of evaporation.

these different channels may be seen by the following tables:

By radiation and conduction from skin	73.0 per cent.
By evaporation of water from skin	14.5 per cent.
By expired air	10.7 per cent.
By urine and feces	1.8 per cent.

The loss of heat due to the ingestion of cold food and drink is so small that it need hardly be counted.

Certain conditions, such as changes in external temperature, may cause considerable difference in the per cents given above, especially in radiation and evaporation; *e. g.*, a high external temperature will diminish the loss of heat by radiation and increase that by evaporation owing to the greater production of sweat that occurs when the body becomes heated.

HEAT REGULATION.—The balance between heat production and heat elimination is adjusted principally by the thermotaxic[1] nerve-mechanism. When the outer air becomes cooler, the blood-vessels by the influence of the nerves are made to contract,[2] and consequently there is less blood at the surface of the body to become chilled and more in the interior of the body to further oxidation. If the cold becomes intense, increased muscular contraction—shivering—occurs, and as muscular contraction always induces increased oxidation in the muscles and consequently extra heat production, the extra loss of heat on account of the cold exterior is made good. When, on the contrary, the external air is unusually warm, the skin blood-vessels, under the influence of the nervous system, become dilated, so that there is more blood

[1] From two Greek words signifying heat regulation.

[2] For fuller description see *Anatomy and Physiology.*

near the surface of the body and consequently a greater amount of heat is lost by radiation, except when the external temperature is near the body temperature. Also, the degree of perspiration is increased and, consequently, loss of heat by evaporation. The loss of heat by evaporation is not interfered with when the surrounding air becomes heated to or over body temperature, as is that by radiation, unless there is a high degree of humidity; but it is interfered with when the humidity is excessive. This was discussed in Chapter III.

In addition to the involuntary or nerve control of heat regulation, individuals adopt certain voluntary means of regulating heat; thus, when we feel cold, we put on warmer clothing, eat more, drink more hot liquids, take more vigorous exercise, and so on, but when hot, we do the reverse of all these things.

Normal Temperature.—The temperature of the human adult body when in health, as registered by the thermometer, is about 98.6° F., but it is subject to diurnal physiological fluctuations of a fraction of a degree. In health, the temperature rises gradually from 7 or 8 A.M. until the same time in the evening, when it gradually falls. Thus it reaches its maximum between 5 and 8 P.M., and its minimum between 2 and 6 A.M. In infants and children, the average temperature is generally somewhat higher than in adults, while in old people it is somewhat lower.

Causes of Variation in Temperature.—A slight rise of temperature may occur in even a healthy individual from such causes as excessive exercise or excitement, constipation, or an attack of indigestion. The most common reason for any great rise of temperature —fever—is the presence of toxic substances in the

blood. Toxic matter that gives rise to fever is usually the result of bacterial activity in the body, but it may be due to such constitutional disturbances as are caused by perverted metabolism. The temperature of children is more easily affected by any of these conditions than that of adults.

Some of the more common causes of a drop in the temperature are: vomiting, diarrhea, lowered vitality, hemorrhage, shock—in fact, anything which depresses the nervous system may cause lowering of the temperature.

Variations in Temperature that can Occur without Causing Death.—That the body can stand a greater increase than decrease in temperature can be seen by the following table. The table also gives the terms applied to the various degrees of temperature:

	Fahrenheit	Centigrade
Hyperpyrexia	106° and over	41°
High fever	103° — 106°	39° — 41°
Moderate fever	101° — 103°	38° — 39°
Subfebrile	99° — 101°	37° — 38°
Normal	98° — 99°	36.5° — 37°
Subnormal	97° — 96°	36° — 35.5°
Collapse	96° — 95°	35.5° — 35°
Algid collapse	Below 95°	35°

Reasons for Death from Subnormal Temperature.—When the temperature drops much below 95° F., life cannot be supported, because there is not enough heat to keep the body mechanism (the heart, lungs, etc.), at work. The vital organs of the body can no more perform their function without a certain quantity of heat than can any steam-driven machinery.

The causes of the lowered temperature of course contribute to the impossibility of the continuance of life; *e. g.*, all vital functions are dependent upon the activity of the nervous system: therefore, when this system becomes so depressed that it fails to innervate —send impulses to—the organs, the latter will cease to work.

Reasons for Death from High Temperature.—Death as the direct result of high temperature is due largely to changes caused by the heat in the body tissues, but usually it is the effect on the body of the toxins or conditions causing the fever that produces death rather than the heat.

Difference in the Degree of Temperature Showing Dangerous Conditions in Different Diseases.—The degree of temperature which gives alarm varies in different diseases; *e.g.*, patients have often recovered from sunstroke after a temperature of 112° F. and even 115° F.; in malaria, the temperature will often rise to 106° or 107° F; in pneumonia, 105° F. is a frequent temperature, but this is considered high in typhoid, and 104° F. indicates a very dangerous condition in diphtheria.

Use of Fever—Why Antipyretic Measures are Taken.—Until recent years, fever was combated by all known means, merely for the reduction of the temperature, but the present theory is that fever is often one of nature's means of protecting the body, because it has been found that when the fever is due to bacterial invasion the body can fight the invading germs better when the temperature is high than when it is normal. Therefore, unless the fever is due to causes other than bacteria—as sunstroke—or the temperature remains persistently high, measures to

reduce it, other than by giving cool baths, are not taken, and the baths are given, not so much for the reduction of temperature as for the relief of other abnormal conditions present. These will be discussed in the following chapter. When the temperature is very high, however, as in sunstroke, or when it remains persistently high, the heat in itself is dangerous, because it produces changes in the body tissues that are incompatible with life.

How Toxins Cause Fever.—The presence of toxic substances in the blood, it is thought, depresses that part of the nervous mechanism which responds to alterations in the body temperature, so that the nerve impulses which bring about the conditions (described on page 294) which increase loss of heat from the body, are interfered with.

Stages of Fever.—The course of fever is marked by three stages, viz.:

(1) Invasion or onset, the period in which the temperature rises until it reaches its maximum. This may occur suddenly, as in pneumonia, or slowly, as in typhoid.

(2) Fastigium, or stadium, the period in which, though there may be marked variations, the temperature remains more or less the same and repeatedly touches its highest point.

(3) Defervescence, the period in which the temperature falls until it reaches the normal.

Termination of Fever.—Fever is said to terminate by *crisis* or by *lysis*. The former term signifies a sudden drop in the temperature with gradual improvement in other abnormal conditions[1]; the

[1] A sudden drop in temperature not accompanied by improvement in the pulse, etc., is to be regarded with suspicion, as this

temperature may drop four or five degrees in a few hours. The term *lysis* is used when the temperature drops slowly, sometimes taking several days to reach normal. The fevers apt to end by crisis are: pneumonia, malaria, measles, erysipelas, relapsing, typhus.

Types of Fever.—Fever is classified according to the course it runs, as continuous, remittent, or intermittent. It is said to be continuous when it is constantly high with but slight diurnal fluctuations. Examples of continued fevers are pneumonia, scarlet, and typhus. Fever is called remittent when it remains above normal, but with considerable range between its highest and lowest points; typhoid fever, remittent fever, and septic fever are common examples of this type. Septic fever is sometimes intermittent. Intermittent fevers are those in which the temperature alternately rises to febrile height and falls to or below normal, as in malaria. In some fevers, there is but one remission; *e. g.*, in measles, smallpox, yellow fever, and dengue, a marked remission usually occurs about the second to fourth day, but this may be the only marked remission until convalescence is established.

Value of a Knowledge of the Course of the Temperature.—As can be judged from the preceding paragraphs, the temperature runs a characteristic course in many diseases; therefore a knowledge of the course of a patient's temperature is of great diagnostic value, and as the temperature generally grows nearer or farther from normal, as the conditions causing the fever or subnormal temperature improve or grow worse, the temperature often gives information also

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happens when there are hemorrhage, shock, and certain other serious complications.

as to the patient's general state. This is, however, not always the case, and the state of the pulse and respiration, as well as all other symptoms that may be present, must be considered. A person may die while his or her temperature is normal.

Diurnal variations in the temperature take place in disease as well as in health and, as previously stated, the maximum and minimum height occurs, normally, at about the same time each day; therefore, to gain an accurate conception of the course the temperature is running, it is necessary to take it at about the same time every day.

THE THERMOMETER.—The self-registering clinical thermometer is the instrument used for ascertaining the body temperature. It consists of a glass bulb filled with mercury and a stem on which there is a graduated scale. Mercury is expanded by heat, and when the bulb is placed in a warm place the mercury expands and sends a column along the graduated scale. The height the column will reach will depend upon the degree of temperature. As clinical thermometers are self-registering—*i. e.*, the mercury stays at the height to which it ascends until shaken down—it is necessary, before using the thermometer, to see that the mercury is down to 95° F. To shake down the mercury, hold the thermometer between the first and second fingers and the thumb with the bulb end downward; do not let the bulb extend far beyond the hand; if it does, it is likely to knock against something, or the thermometer may slip from the hand, and thermometers are easily broken; flex the hand somewhat and give it a quick, sharp jerk. Do not shake the mercury below 95°. If it gets into the bulb, it may be impossible to get it up again. To try and get it up,

put the thermometer into water about 108° F. The temperature of the water must not exceed the temperature scale on the thermometer.

Care of Thermometers.—Keep the thermometer, when not in use, in a glass two-thirds full of bichlorid of mercury 1 : 1000, or other disinfectant of equal strength. Especially for children, it is better to have a separate thermometer for each patient, but this is not always practicable. Wipe a thermometer carefully before giving it to a patient. When you use the same thermometer for more than one patient, wash it between uses in: (1) cold water and (2) in a disinfectant. After use, wash the thermometers in soap and water about 98° F. and return them to the jar of solution. This solution should be changed at least twice in twelve hours.

Even the best thermometers should be compared occasionally with some standard, as the bulbs gradually contract and the thermometers then register incorrectly. In the hospital, owing to the constant breakage, it is necessary to use cheap thermometers; therefore, it is important to test them weekly. To do so, put them into a glass of water, 100° F., with a reliable chemical or dairy thermometer. Allow them to remain there five minutes; then discard those which show any considerable variation from the standard thermometer. The discarded thermometers can, as a rule, be returned to the makers for repairs.

Where the Temperature is Taken.—The temperature is commonly taken in either the mouth, rectum, or axilla, for these locations form more or less closed cavities in which large blood-vessels approach the surface.

Precautions to Observe when Taking the Temperature by Mouth.—When taking the temperature by mouth, be sure that the patient has not had anything cold or hot in her mouth recently. Place the end of the thermometer containing the mercury under the tongue, on either side, close to the arteries. See that the lips are kept tightly closed all the time the thermometer is in the mouth, and do not leave it there longer than is necessary. The length of time required will depend upon the thermometer used. Hick's best Kew Observatory Certificate Thermometer registers in half a minute, but, as it is necessary for the mouth to be closed at least two minutes to insure its temperature being unchanged by the outer air, the thermometer should be left in that length of time. Cheaper grades of thermometers require from three to five minutes for registration.

Never take the temperature of a young child, of a delirious or unconscious patient, or of a patient who is troubled with dyspnea or who is coughing, by mouth; in the first three cases there is danger that the bulb will be bitten off, and under the other two circumstances it will be hard for the patient to keep her mouth closed. The danger to the patient attending biting off the bulb lies not so much in the fact that the patient may swallow the mercury as that she may swallow sharp particles of glass, because mercury in its metallic form is inert and would probably be discharged through the intestines without doing any harm. Therefore, should a thermometer be broken in the patient's mouth, the first thing to do is to see that there are no particles of glass left in her mouth. The physician should be notified of the accident. The white of egg, which is the chemical antidote for

mercury, is sometimes given as a precautionary measure, though, as previously stated, so long as it is in metal form, the mercury is not likely to do any harm.

Rectal Temperature.—Oil the bulb of the thermometer before inserting it in the rectum. Allow three to five minutes for registration; if, when the thermometer is removed, it is coated with feces, put a rubber finger cot on your index finger and free the rectum from feces and then take the temperature again, for it is not the accurate body temperature that is obtained when the thermometer is inserted in a mass of feces, but that of the decomposing fecal matter, which is usually higher than the body temperature. When taken by rectum, the temperature will be about one degree higher than it would be if taken by mouth. Never take the temperature by rectum when the rectum is diseased, and never allow a sick patient to insert the thermometer herself. If an infant struggles while you are taking its temperature, turn it on its face, or hold it face downward on your knee. When inserting the thermometer with the child so placed, point it downward, toward the umbilicus, for the axis of the rectum is changed by this position.

The Axillary Temperature.—Before inserting the thermometer in the axilla, wipe the latter thoroughly, place the bulb in the hollow of the armpit, with the stem of the thermometer pointing toward the chest, and see that the patient holds her arm pressed closely to her side. Allow ten minutes for registration. The axillary temperature is apt to be slightly lower than the mouth temperature.

Children, hysterical, delirious, or fractious patients,

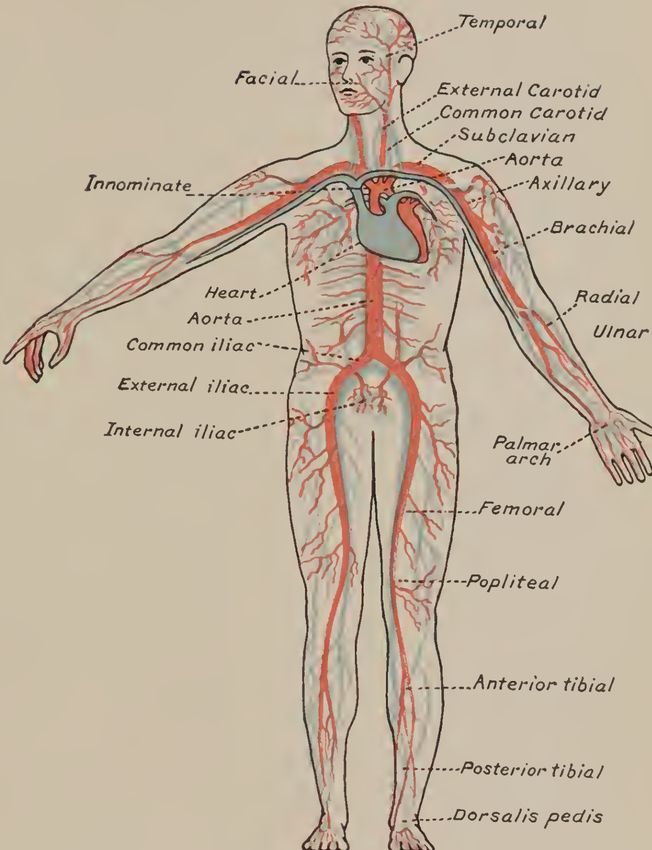

FIG. 17.—DIAGRAM SHOWING PLAN OF DISTRIBUTION OF ARTERIES AND VEINS

should never be left while their temperature is being taken. Hysterical patients often resort to many mechanical devices, such as moving the thermometer in the mouth, holding it on a hot-water bag, etc., to obtain high registration.

The temperature must be not only accurately taken, but accurately recorded. The giving of drugs and treatments likely to affect the temperature is usually recorded on the temperature chart.

A patient should never have access to her chart, and all questions regarding her temperature and condition should be evaded as far as possible.

The Pulse

What It Is.—The pulse is the distention of the arteries by a wave of blood forced through them by the contractive or systolic action of the heart. The interval between the pulse-beats is the period occupied by the diastole or relaxation of the ventricles of the heart as they fill with blood.

Where the Pulse can be Felt.—Wherever a large artery approaches the surface of the body, its pulsation can be felt and counted. The arteries which do so, and the locations in which they can be most readily felt, are as follows: (1) the radial arteries, at the wrist, on the thumb side; (2) the facial arteries, where they pass over the lower jawbone, which is about on a line with the angles of the mouth; (3) the temporal arteries, a little above and to the outer side of the outer angles of the eyes; (4) the femoral arteries, where they pass over the pelvic bones; (5) the dorsalis pedis on the dorsum of the foot—see Fig. 17.

Points to Notice when Counting the Pulse.—The principal points for a nurse to notice in connection

with the pulse are its frequency, force, regularity, tension, and if it is dicrotic.

How to Take the Pulse.—Place your index and middle fingers over the artery, making slight pressure. Count for a full minute, dividing the minute into quarters—the object of the division is to discover whether the frequency of the pulse is regular or irregular.

Points to Remember when Taking the Pulse.—(1) Never count the pulse with your thumb, for there is a superficial artery in the thumb and you might count your own pulse instead of the patient's. (2) Do not make too strong pressure when counting the pulse, for if the pulsation is feeble, strong pressure will obliterate it—this is a common fault of beginners. (3) When taking the pulse at the radial artery, let the patient's arm be at rest on the bed or a table. (4) When taking the pulse of a patient for the first time, always take it in both wrists to ascertain if it can be felt equally well in both, for sometimes, owing to an unusual distribution of the arteries, an aneurism or traumatism, there is an appreciable difference between the two pulses. (5) When a weak pulse seems slower than it should be, count the pulsation of the heart, preferably with the stethoscope, for the apparent slowness of the pulse may be due to the feebleness of the heart-beat on account of which the arteries do not always become sufficiently distended to give rise to a perceptible pulsation. The beat of the apex will be heard about an inch below the left nipple. (6) Either before or after counting the pulse hold the fingers over the artery long enough to note the characteristics other than frequency that it is important to observe.

FREQUENCY.—By frequency of the pulse is meant the number of pulsations in a given time. This varies even in health—in different people and conditions.

The average frequency of the pulse is:

In men	60– 70	beats per minute.
In women	65– 80	
In children, above seven years	72– 90	
In children, from one to seven	80–120	
In infants	110–130	
At birth	130–160	

Even in health, exercise, excitement, and sudden emotion will all cause an increase in the frequency of the heart-beat. Position will also cause slight alterations, the pulse being about 10 beats more per minute quicker when a person is standing than when sitting, and about 5 beats more when sitting than when lying down. Thus, if a patient remains in the recumbent position, her heart will be spared about 21,600 beats a day. This is one reason why it is important to keep patients in such a position when the pulse-rate is frequent.

ABNORMAL CONDITIONS WHICH CAUSE AN INCREASED PULSE-RATE.—Some of the more important are: (1) The conditions which cause a rise of temperature—a rapid pulse is as much a symptom of fever as a rise of temperature, and the nature of the pulse is a better indication of the patient's condition than the temperature. (2) Over-stimulation of the nervous system, such as is caused by exophthalmic goitre and some drugs. (3) Hysteria. (4) Neurasthenia. (5)

Heart troubles. (6) Hemorrhage. (7) Shock and collapse.[1] One of the reasons for rapid heart action in shock and collapse is the same as in hemorrhage—viz., the heart has not got a sufficient supply of fluid; the deficiency of fluid in shock and collapse being due to the fact that the depression of the nervous system characteristic of these conditions, results in such dilation of the large abdominal blood-vessels that the blood collects there and the heart and tissues are as truly deprived of blood as by hemorrhage. When the heart-beat is very rapid, the condition is called *tachycardia.*

Conditions which Cause Slowing of the Heart-Beat.—The more common causes of *bradycardia*—*i. e.*, an abnormally slow pulse-rate—are: (1) Intracerebral pressure that irritates the vagi[2]; (2) Depression of the nervous system, such as occurs in myxedema, or as the result of over-doses of certain drugs as opium. (3) Poisoning by, or the continued use of, drugs, such as digitalis, which stimulate the vagi. (4) Toxemias, such as uremia and jaundice.(5) Certain forms of organic heart disease. (6) Convalescence from febrile diseases.

Usual Ratio of the Pulse and Temperature.—The usual pulse temperature ratio is as follows:

A temperature of 98.4° F. corresponds to a pulse of 70.

[1] Shock and collapse are practically the same, the first term being applied when the condition is produced as the result of accidents or following operations; the second term, when the conditions occur in the course of illness.

[2] It will be remembered that stimulation of the cardiac nerves derived from the sympathetic system accelerates the heart-beat, and stimulation of the vagi or tenth cranial nerves inhibits or slows the heart action.

A temperature of 100° F. corresponds to a pulse of 80–90.

A temperature of 102° F. corresponds to a pulse of 100–110.

A temperature of 104° F. corresponds to a pulse of 120–130.

In some diseases, however, especially in pneumonia, the pulse-rate is likely to be more frequent, and in other fevers, as typhoid, meningitis, and yellow fever, the pulse is usually, unless complications occur, less frequent in comparison to the rise in temperature. When the pulse-rate becomes accelerated in an undue ratio to the rise in temperature, cardiac weakness—or in typhoid, hemorrhage—is indicated.

FORCE.—The points to notice in the force of the pulse are whether the pulsations are of normal force or whether they are feeble, or, on the contrary, full and bounding; whether all pulsations are of equal force or whether some are weak and others strong; when this is the case, the force of the pulse is said to be irregular.

REGULARITY.—The pulsations of a normal pulse are all of almost equal strength and the interval between pulsations is of equal length—in other words, the pulse is regular in force and frequency. In illness, however, various forms of irregularity may occur, some of the more common of which are:

(1) Irregularity in frequency—*i. e.*, a shorter or longer interval between some beats than others.

(2) Irregularity in force; this has been already described.

Organic heart disease and weakening of the heart action from any cause are common reasons for these two forms of irregularity.

(3) Intermittent pulsation—*i. e.*, at either regular or irregular intervals, there is apparently an intermission in the heart-beat due to failure of the arteries to distend properly. When this occurs in the course of an illness, it may be due to a relaxed condition of the arteries or a weakened heart, but it sometimes occurs in comparatively healthy individuals, especially in the aged and in those addicted to the over-use of alcohol, coffee, tea, or to smoking. When a pulse intermits, it is necessary to count the apex-beat to gain an accurate idea of the frequency of the heart-beat.

Dicrotic Pulse.—The so-called *dicrotic*[1] *pulse* frequently occurs in typhoid and other diseases that cause a depleted condition of the system. It is due to lack of tone of the arterial walls. The pulse is said to be dicrotic when some of the beats are, as it were, divided, the second part of the beat being weaker than the first. It results because the aorta, on account of its relaxed condition, fails to contract properly when the blood is forced into it by the heart's systole, and then, when it becomes distended with blood, it contracts suddenly, thereby driving the blood backward against the semilunar valves. This closes the valves, and the blood is consequently forced back through the arteries and gives rise to the second wave or pulsation. As the two beats of a dicrotic pulse represent but one contraction of the heart they are to be counted as one.

Water-Hammer Pulse (Corrigan's Pulse.)—The abnormal condition of the pulse that has been so named is characterized by a quick, powerful beat which suddenly collapses, and in which the pulsation

[1] From a Greek word which signifies "beating double."

can be seen in the carotids and frequently in the brachial arteries. This pulse is diagnostic of aortic regurgitation during the period of compensation.[1] The force of the beat is due to the large quantity of blood that is forced into the aorta by the enlarged ventricle; the sudden collapse is due to failure on the part of the defective valves to support the column of blood in the aorta.

Tension, Pressure.—In speaking of the tension of the blood-vessels and of blood pressure, practically the same condition is referred to, tension being the strain on a blood-vessel when filled with blood, and pressure signifying the force exerted by the blood on the walls of the blood-vessels. The degree of pressure which the blood exerts varies in the different vessels and during the systole and diastole of the heart, being greatest in the arteries and least in the capillaries, and higher during systole than diastole.

How to Recognize High and Low Blood Pressure.—Differences in blood pressure may be roughly estimated by noting the amount of force that is required to arrest the pulse at the wrist by pressing the fingers upon the radial artery. When the blood pressure is low, the pulse is very compressible, and pulsation can be obliterated by making slight pressure with the fingers. When, on the other hand, the tension or pressure is high, the pulse wave is not easily stopped, and even when hard pressure is made with the fingers, pulsation will be felt along the artery below where the pressure is made. Estimation of the degree of blood pressure made in this way is not very accurate, however, and the sphygmomanometer is usually used for the purpose. The sphygmoma-

[1] See page 764.

nometer consists of: (1) an elastic bag outside of which is a leather cuff; (2) a mercury manometer which is connected with the elastic bag by means of rubber tubing and also with (3) an air-pump. The manner of using the apparatus is as follows: The elastic bag

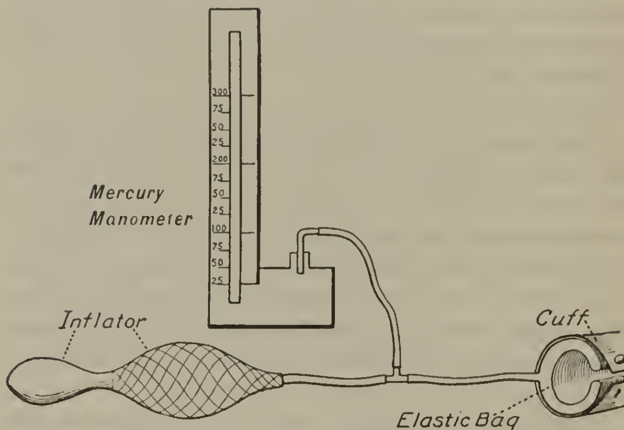

Fig. 18. Sphygmomanometer

covered with the cuff is strapped around the patient's arm and then inflated by working the pump until no pulsation can be felt in the radial artery at the wrist. The height at which the mercury stands in the manometer is then read. This gives the maximum or systolic pressure. The pressure on the arm is then reduced until the widest oscillations of the mercury column are obtained, and the lowest position of the mercury meniscus gives the minimum or diastolic blood pressure.

Average Normal Degree of Blood Pressure.—The systolic pressure, when the subject is about 30 or 35 years of age and in good health, raises the mer-

cury in the manometer about 110 to 120 millimeters and diastolic pressure raises it 75 to 85 millimeters, therefore the normal systolic blood pressure for these ages is said to be 110 to 120 mms. (millimeters) and the diastolic pressure 75 to 85 mms.

Conditions which Cause Variation in Tension.—Blood pressure is higher in adults than in children, and greater in old age after the arteries have lost their elasticity than in youth and middle age. Also blood pressure varies somewhat in every individual, even in health, all the conditions that cause changes in the force and frequency of the heart-beat changing the degree of pressure.

Some of the abnormal causes of high pressure are chronic nephritis, hypertrophy of the heart, angina pectoris, almost any condition causing cerebral pressure, gout, and lead poisoning.

Among the more common causes of abnormally low blood-pressure are shock, collapse, hemorrhage, acute infectious diseases, acute cardiac diseases, diseases which cause a general loss of tone, diarrhea, excessive vomiting.

Blood pressure is influenced also by certain drugs. Those which induce contraction and the condition of tone in the arteries, as adrenalin and digitalis, raise the pressure, and those which relax arterial tension, as nitroglycerin, reduce the pressure.

Hardening of the Arteries.—The normal radial artery of a young person cannot be felt, but in old age and sometimes in comparatively young people, as the result of disease, the arteries become thickened and their tissues hardened, so that the artery can be felt. When this condition, which is known as arteriosclerosis, is present, it should be observed.

VENOUS PULSE.—As the result of some heart abnormalities, a relaxed condition of the arterioles, or severe anemia, pulsation is sometimes seen in some of the veins, more especially the jugular vein and veins on the dorsum of the hand.

CAPILLARY PULSE.—Occasionally, in conditions of the heart which give rise to aortic regurgitation, in exophthalmic goitre, severe anemia, and neurasthenia, pulsation can be detected in the capillaries. It can be seen most easily in the lip if it is blanched by pressing a glass slide upon it. A nurse would not be expected to recognize a capillary pulse. It is merely mentioned here as matter of interest.

EXPRESSIONS MOST COMMONLY USED IN DESCRIBING THE PULSE.—In describing the frequency of the pulse, the expressions "frequent" and "infrequent" are more correct than "quick" and "slow," since the latter terms may refer to the rate of the pulsation as well as to the interval between pulsations. A pulse between 100 and 120 per minute may be called a "rapid" pulse, and one over 120 a "running" pulse. A pulse in which the beats are of more than usual force is generally of such a character that the terms "full" or "bounding" describe it, and one in which the force is below normal may be described, according to the degree of lack of force, as "weak," "feeble," "soft," "flickering." The weak running pulse, characteristic of hemorrhage and extreme exhaustion, is often referred to as a *thready pulse*. When describing the regularity of the pulse, the terms "regular" or "irregular" in force or in frequency are usually used, if beats are apparently dropped, intermittent, or if the beat is divided—as previously described, "dicrotic."

Respiration

Purpose.—The purpose of respiration is (1) to supply the body with the oxygen that it requires for tissue building, and to maintain the continual oxidation necessary to provide the heat required to keep the body warm and to supply the energy requisite to retain the mechanism of the body at work; (2) to rid the body of the excess carbon dioxide resulting from this oxidation; (3) to help equalize the temperature of the body; (4) to help rid the body of excess water.

External and Internal Respiration.—In order that respiration may accomplish all the purposes mentioned in the preceding paragraph, two distinct processes are necessary, viz.: external and internal respiration. The former process takes place in the lungs and consists in the elimination of some of the carbon dioxide that the blood has brought from the tissues, and of the absorption of oxygen from the air. Internal respiration, which is taking place unceasingly in the tissues consists of (1) the diffusion of oxygen from the blood-vessels into the tissues; (2) its union there with substances in and of the tissues, and (3) their consequent breaking down into simpler substances, such as carbon dioxide and water, and (4) the passage of these substances into the blood and lymph vessels.

External Respiration

Of What It Consists.—External respiration consists of the alternate expansion and contraction of the chest walls and the lungs by means of which air is drawn into, and expelled from, the lungs. The first

action is known as inspiration; the second is known as expiration.

Mechanism of Inspiration.—During inspiration, the diaphragm contracts, its dome becomes flattened and is pulled downward, its sides are drawn away from the chest walls. At the same time the contraction of certain of the muscles of the thorax (see next paragraph) elevates the ribs in front and at the sides; the size of the thorax is thus considerably enlarged, and as the lung substance expands in keeping with the sides and floor of the thorax, a vacuum is created in the air-cells, which the outside air is sucked in to fill.

Muscles Concerned in Inspiration.—These are the diaphragm,[1] the external intercostals, part of the internal intercostals, the scaleni, the levatores costarum, the muscles of the glottis, and, in hurried or forced breathing, those around the nostrils.

Mechanism of Expiration.—In expiration, the lungs and the thorax return to the position and size they occupied before the act of inspiration, and air is thus expelled from the lungs. Quiet expiration is an almost passive act, due in part to the elastic recoil of the muscles and tissues involved in inspiration. In forced expiration, however, many of the abdominal muscles are involved. These act (1) by pressing the abdominal viscera against the diaphragm and thereby forcing it up; (2) by drawing down the ribs and costal cartilages.[2]

Nature of Respiratory Movements.—Respira-

[1] The action of the diaphragm is much more pronounced in men and children than in women. This is thought to be due to a difference in clothing rather than to physiological differences.

[2] It will be remembered that the abdominal muscles are attached to the ribs and costal cartilages.

tion is both a voluntary and an involuntary act; that is to say, it can be controlled to a certain extent by the will, but, except on occasion, it proceeds without any voluntary effort. In fact, any attempt to modify the respiratory rhythm must soon cease from one or other of two causes, viz.: (1) conscious effort will soon be followed by such a sense of fatigue that it will be discontinued; (2) continued interference with the ordinary rhythm of respiration will produce an abnormal increase in the amount of carbon dioxide in the blood, which, by stimulating that part of the medulla oblongata known as the respiratory center, will eventually cause inspiration.

Cause of Inspiration.—Unlike the beat of the heart, the respiratory movements are entirely dependent on the nervous system, especially that part known as the respiratory center. Anatomically the respiratory center has not been sharply localized further than that it is in the medulla oblongata and below the center which controls the vasomotor system. It is brought into relation with the muscles of respiration by efferent nerves which, arising in the center, (1) pass down the cord and end in the gray matter there at the different levels at which the motor nuclei of the respiratory nerves are situated, and (2) which pass on to such of the motor centers of the vagus and facial nerves as are connected with any of the muscles of respiration. The impulses arising in the respiratory centers are thus transmitted to the nerves which cause action in the muscles concerned in the act of inspiration.

Causes of the Activity of the Respiratory Center.—Numerous experiments have shown conclusively that the respiratory center, like the heart,

works automatically—*i.e.*, the stimuli discharged from it are produced within its own cells—but that it is also very easily affected by afferent impulses. The stimuli causing the automatic action of the respiratory center are, however, different from those affecting the heart; the stimuli affecting the respiratory center being, it is now almost universally thought, the oxygen and carbon dioxide in the blood passing through the center, it having been found that an excess of oxygen in the blood will cause the center to cease acting, in other words to become *apneic*,[1] and that the same effect will follow the quick removal of carbon dioxide. Therefore, it is now the generally accepted theory that the usual stimulus activating the respiratory center is the carbon dioxide which the blood gathers from the tissues in its voyage through the body. This accounts for the increased rate of respiration in fever—the excessive oxidation that is going on when the temperature is high being naturally associated with an increased production of carbon dioxide.

Influence of the Sensory Nerves on the Respiratory Center.—Though the respiratory center works automatically, it is also influenced by sensory nerves passing to and from the brain. This is shown by the changes caused in respiration by any strong stimulation of these nerves, such as occurs on account of sudden pain, strong emotion, cold, etc., hence one reason for inducing pain in the treatment for opium poisoning, this drug causing death by depression of the respiratory center.

Causes of Expiration.—It is now thought by many physiologists that the respiratory center would

[1] From the Greek, *apnoia*—want of wind.

have been more correctly named the *inspiratory center*, normal respiration actually consisting of an active inspiratory act followed by a passive expiratory movement due, as previously stated, to the elastic recoil of the muscles engaged in inspiration, and in forced respiration, as in dyspnea, coughing, etc. When expiration does become an active movement, it is not known what activates the nerves supplying the muscles engaged in the action. Some authorities consider that the nerve stimulation arises, in dyspnea, from an excessive amount of carbon dioxide in the blood, and in coughing, etc., from increased nerve impulses from the sensory nerves. But other physiologists think that the nerve impulses which activate the muscles causing active expiratory movements are derived from a different center as yet undiscovered —an *expiratory center*.

Causes of Interchange of Gases that Takes Place in Respiration.—It has been stated repeatedly in the preceding pages that carbon dioxide passes from the blood while it is flowing through the pulmonary capillaries, and that oxygen is taken in. This happens because the blood is passing through a region in which there is less carbon dioxide than in itself, and the tendency of gases is always to mix in uniform proportion. Following this same tendency the oxygen, being present in larger amounts in the air-cells than in the blood, passes from the alveoli into the blood in the capillaries.

Internal Respiration

By internal respiration is meant, as previously explained, the interchange of gases—oxygen and carbon dioxide—that takes place between the blood and the

tissues, as the blood flows through the capillaries in the tissues.

Diffusion of Gases.—If a vessel, room, etc., is filled with two or more gases, the gases, even if they are of different densities, will diffuse and intermingle, so that in time each gas will be distributed uniformly through the whole space. This law is followed within the body as well as without the body and as there is always a larger amount of carbon dioxide in the tissues than in the blood, since it is constantly being created in the former as the result of metabolism, the carbon dioxide passes from the tissues to the blood, and as there is less oxygen in the tissues than in the blood (there is practically no free oxygen in the tissues, for on entering them it at once combines with substances therein) the oxygen passes from the blood to the tissues.

Changes in the Blood Due to Respiration.—The principal changes that take place in the blood due to respiration are: (1) it gains oxygen; (2) it loses carbon dioxide; (3) in consequence of these changes, it assumes a redder color; (4) it becomes slightly cooler. The comparative degree of pressure due to carbon dioxide and oxygen in the alveoli, arterial and venous blood, and the tissues is as follows:

	Oxygen	Carbon Dioxide
Alveoli	100 mms.	35–40 mms.
Venous Blood	37.6 mms.	42.6 mms.
Arterial Blood	100 mms.	35 mms.
Tissues	0 mms.	50–70 mms.

Normal Rate of Respiration.—The average rate of respiration for a healthy adult is about 18 respirations per minute, but it is quicker in childhood and

infancy, and somewhat slower in the aged. It may vary, however, very considerably, even in health, for it becomes accelerated as the result of muscular exercise, etc.; in fact, anything that influences the heart-beat will, ordinarily, have a like effect upon the respirations, but, except in diseased conditions, the ratio of the respiration and heart-beats remain about 1 to 4 or 1 to 5.

Abnormal Causes of Increased Respiration.—(1) Fever, as has been already stated, causes an increase in the rate of respiration, because of the over-stimulation of the respiratory center by the excessive amount of carbon dioxide in the blood passing through it—the carbon dioxide having been formed as the result of the increased oxidation taking place in the tissues. (2) Heart disease, by interfering with the circulation, may result in an accumulation of carbon dioxide in the blood and consequent accelerated respiration. (3) Inflammatory conditions of the lungs by interfering with the proper exchange of oxygen and carbon dioxide, as well as by causing pain, will induce rapid respiration. (4) Anemia, on account of the deficiency of hemoglobin characteristic of this condition, will interfere with the oxygen supply of the tissues, and thus result in quickened respiration. (5) Hemorrhage and shock for a like reason will have a similar effect, and the respiration will have a characteristic sighing sound. (6) Abdominal and thoracic pain will produce quickened respiration because (*a*), when such exists, the patient does not take sufficiently deep respirations to further enough interchange of gases to get rid of the usual amount of carbon dioxide; (*b*) stimulation of the sensory nerves by the pain causes increased stimulation of the motor nerves

concerned in respiration. (7) Hysteria and nervousness. (8) Cerebral affections which stimulate the respiratory center. (9) Certain drugs and other agents, such as cold, cause deeper and more frequent respirations, but these, unless used in excess, will produce only a desired quickening.

Abnormal Causes of Infrequent Respirations. —The most common cause of decrease of the rate of respiration in proportion to the pulse is depression of the respiratory center. This may be caused by certain abnormal conditions in the brain, as in meningitis, tumor, apoplexy; by certain forms of coma, particularly uremic and diabetic; by overdosing with certain drugs, especially opium; by obstruction to the air-passages, as in asthma and in laryngeal spasm.

It is a very serious matter when the respirations fall to or below 8 per minute, or become more frequent than 40 per minute, as the blood cannot under such conditions become properly aërated.

How to Count the Respirations.—As already stated, the respiratory movements are, to a certain extent, under a person's control; therefore, they should be counted without a patient's knowledge. To do this, keep your fingers upon the pulse, as though still counting it, while you count the respiration. Watch the rise and fall of the chest wall and count the two movements—which correspond to inspiration and expiration—as one respiration. Count for one minute.

Conditions Other than Frequency that are to be Observed in the Respiration:

(1) It is to be noted whether the respirations are shallow or deep and whether, or not, the thoracic walls are expanded normally. Some of the more common causes of shallow respiration are depression of the

nervous system and abdominal or thoracic pain. When caused by thoracic pain, as in pleurisy, pneumonia, or tuberculosis, there is also, usually, a failure to expand the chest properly. Sometimes this defect is confined to the affected side and this helps to show the location of the trouble. Abnormally deep respirations are most commonly due to pressure on the brain as the result of either injury or disease.

(2) It is to be noted if dyspnea is present. Dyspnea as stated in Chapter VIII is difficult or labored breathing. It may or may not be associated with pain and the rate of respiration may be either abnormally frequent or infrequent, or normal; as a rule, it is abnormally frequent. When dyspnea is at all severe, the patient is usually cyanosed.

The more common causes of dyspnea are: (*a*) Conditions of the lungs which interfere with the normal frequency and depth of respiration or with the proper interchange of gases in the lungs, as in pneumonia and edema of the lungs. (*b*) Obstruction in the larynx or bronchi by foreign bodies, growths, inflammatory conditions, constriction, or spasms—as in croup or asthma. (*c*) Heart diseases, which interfere with the proper circulation of blood in the lungs. (*d*) Anemia, which, being characterized by a deficiency of hemoglobin, the substance in the red blood corpuscles with which the oxygen unites, depletes the oxygen supply of the tissues. (*e*) Depression of the respiratory center, either as the result of pressure on the brain, of drugs—as opium—or of toxic substances formed in the body.

When dyspnea is so severe that the patient is unable to breathe in a recumbent position, the condition is known as *orthopnea*.

(3) *Apnea. Cheyne-Stokes Respiration.*—When respiration ceases entirely for a few seconds, the condition is known as *apnea.* This is most commonly seen in connection with what is known as Cheyne-Stokes[1] respiration. The apnea is due in this case to the fact that the patient breathes very rapidly for a while and so gets an over-supply of oxygen and, as stated on page 274, an excess of oxygen in the blood will cause the respiratory center to stop acting. Cheyne-Stokes breathing is seen most frequently in patients suffering with kidney and heart diseases, arteriosclerosis, meningitis, coma, and following injury to the brain. It is a more serious symptom in the three conditions mentioned last. Cheyne-Stokes breathing has been noted also in perfectly healthy children during profound sleep. Cheyne-Stokes respiration appears in two forms. In one, the respirations gradually increase in force and frequency up to a certain point and then as gradually decrease until they entirely cease—a short pause ensuing before they begin again. In the other, the respirations gradually increase in force and frequency, likewise, but cease suddenly instead of decreasing gradually. This phenomenon may continue for some time. The causes of Cheyne-Stokes respiration are as yet imperfectly understood.

(4) Edematous breathing is an abnormal form of respiration that must be noted the minute it begins, for it is not only a serious symptom, but an exceedingly dangerous condition. It is brought about by infiltration of serum from the lung capillaries into the

[1] So called from the two physicians who first drew attention to this form of breathing.

air sacs and anything which will seriously interfere with the circulation of the blood in the lungs may bring about the condition. It is recognized by characteristic, loud, moist, rattling râles caused by the air passing through the fluid in the air-sacs. It is always associated with dyspnea and cyanosis.

(5) Stertorous breathing also should be noted when present, though it is not necessarily connected with a serious condition. It is due to a relaxed condition of the soft palate and is characterized by a deep, snoring sound in connection with each inspiration. Stertorous breathing is nearly always present in apoplexy and the cheeks puff out with each breath.

To recapitulate, abnormal respiration results when from any cause the tissues are not getting the required quantity of oxygen or there is a tendency for carbon dioxide to accumulate in the system. The more common causes of these conditions are: (1) abnormalities in the blood, as in anemia; (2) loss of blood supply to the tissues, as in hemorrhage and shock; (3) conditions in the lungs which interfere with the proper exchange of gases; (4) any conditions which interfere with the circulation of blood in the lungs—these are most commonly the result of cardiac affections or of cerebral conditions, that affect the vasomotor system or the vagi; (5) cerebral affections; (6) constitutional disturbances which give rise to toxins; (7) large doses of drugs that either depress or over-stimulate the center which controls the muscles of respiration—the *respiratory center.*

CHAPTER XI

BATHS AND PACKS FOR THERAPEUTIC PURPOSES

The Effect of Cold and of Reaction from Cold. Conditions that Help and Prevent Reaction. The Physical Properties of Water that Give it its Cooling Power. Physiological Action of Heat. Why Death is Caused by Heat. Action of Sun's Rays and Electric Light Rays on the Body. Purposes of and Methods of Giving Cold, Neutral, and Hot Baths and Packs. Methods of Giving Electric Light Baths. Purposes, Nature, and Methods of Giving Bran, Bicarbonate of Soda, Sulphur, Mustard, Nauheim, and Salt Baths. Methods of Giving Salt Rubs.

The Principal Uses of Baths for Therapeutic Purposes.—These are: (1) For stimulation of the circulation, (2) as nerve sedatives and nerve tonics, (3) for the reduction of temperature and inflammatory conditions, (4) as counter-irritants, (5) to induce perspiration, (6) various forms of medicated baths are used, both for their local effect on the skin and their general action upon the system.

Before describing the methods of giving baths and packs for therapeutic purposes, we will consider the effect of cold, heat, and light upon the body.

Action of Cold

Principal Purposes of Cold Applications.—The chief purposes for which cold is most commonly applied to the body are: (1) stimulation of the vital

processes—*e. g.*, circulation, respiration, etc.; (2) the relief of congestion; (3) stimulation and quieting of the nervous system; (4) the reduction of temperature.

To what the Stimulating Effect of Cold Is Due.—Cold, though used to produce stimulation of the vital processes, is, under all circumstances and in all modes of application, a depressant, and the stimulating effects which will follow its use if it is properly applied, are the result of the reaction; *i. e.*, the reflex vital activities, by which the body defends itself against injury from the loss of heat as the result of the application of the cold.[1] This will be further discussed on page 285.

Physiological Action of Cold on the Body.—The principal results of cold applications to the body are: (1) Muscular contraction and, as muscular contraction results in increased oxidation, increased heat production. If the exposure to cold is continued for any length of time, unless friction is employed, the muscular contraction becomes so excessive that the condition known as shivering results and then there will be a decided increase in the temperature; later, if the exposure is continued, the muscles may become so chilled that oxidation in them will be checked; this is what happens when a person is frozen. (2) The small blood-vessels contract and the blood is driven from the skin to the interior of the body and excess loss of heat by radiation is thus prevented. The reason why people who have drunk much alcohol freeze to death easily is that the alcohol causes the superficial blood-

[1] The student should read the paragraphs on heat regulation, nerve reflex action, and muscular contraction in her physiology before studying this lesson as it will be then much easier to understand.

vessels to dilate and there is then so much blood near the surface of the body that heat is lost to such an extent that the temperature becomes too low to keep the body mechanism (heart, lungs, etc.) at work. (3) The activity of the skin glands is lessened and perspiration thus checked; this also prevents loss of heat. (4) If the application of cold is sudden, a certain amount of *shock* is produced, in consequence of which the heart rate is momentarily increased, but, afterward, it is lessened. (5) The number of corpuscles in the blood is increased by cold applications due, not as the result of any sudden creation of new ones, but to the contraction of the vessels of the liver, spleen, and other viscera, whereby great numbers of corpuscles which have collected in these vessels are driven into the circulation. (6) The respiration is at first checked but afterward quickened and often gasping.

To Summarize: Cold applications to the body cause: (1) contraction of the small blood-vessels with consequent driving of the blood to the interior of the body and dilation of the large internal vessels; (2) increased muscular contraction; (3) pallor and a goose-flesh appearance of the skin; (4) sensation of chilliness and perhaps shivering; (5) cooling of the skin, but (6) due to increased oxidation in the tissues, a slight rise of internal temperature; this is checked, however, if the cold is too intense and long continued; (7) increase of the number of blood-corpuscles in the circulating blood; (8) first quickening, then slowing of the pulse, with increase of tension; (9) first checked, then quickened and often gasping respirations; (10) the excretion of perspiration is checked.

Reason for these Effects.—The various effects

resulting from the exposure of the body to cold are produced by the action of the nervous system. For instance: muscular contraction, the caliber of the blood-vessels, the action of the heart, respiratory organs, and glands are all controlled by nerves which pass to them from their cells of origin—nerve centers—in the brain, spinal cord, or sympathetic ganglia, and these centers are stimulated by impulses from certain sensory nerves, the endings of which are in the skin and are stimulated by cold.

Cause of Reaction.—Just as the various results of cold upon the body are due to the action of the nervous system, so also is the reaction which ordinarily follows—by reaction being meant the phenomena which arise as the result of the natural reflex response of the nervous system to the effect upon it of the cold.

Nature of Reaction.—A definition of reaction is *action in an opposite or contrary direction to that in which an advance has already been made*, and this is exactly the nature of the phenomena that occur as a result of the action of cold upon the system. Thus: The small superficial blood-vessels dilate and the large internal ones contract, so that an extra amount of blood comes to the surface of the body and blood pressure is increased. The skin becomes somewhat reddened and warm, but body temperature is somewhat lowered, because the greater amount of blood in the skin allows of a greater loss of heat by radiation. The pulse becomes slow, the respiration freer, slower, and deeper, and perspiration may be increased. These changes, it will be perceived, are exactly the opposite of those resulting directly from the cold, and these are the results that are wanted in the therapeutic use of cold. If cold applications are improperly

administered, it may be the effect of cold and not of reaction, that will follow. In order to prevent this, it is necessary to know the conditions that favor and prevent reaction and to apply such knowledge in the giving of treatment.

Conditions which Favor Reaction.—Some of the more important conditions which favor reaction are: (1) Good health and vigor; (2) warmth of the body before the bath; (3) a hot bath given before the cold one; (4) friction on the skin before, during, and after the cold bath; (5) warm surroundings during and after the bath; (6) sudden application of the cold,[1] because the more sudden the application, the greater the strength of nerve stimulation; (7) the percussion effect which is produced when the cold water is applied in the form of a spray or douche; (8) warmth in the form of warm clothing, hot air, or a hot drink after the bath; (9) exercise or friction of the skin following the bath.

Conditions which Retard or Prevent Reaction.—(1) Lowered vitality as in old age, anemia, or long protracted illness; (2) infancy; (3) obesity—on account of the relative anemia of the skin; (4) rheuma-

[1] If a frog whose brain has been destroyed, but spinal cord left intact so that its reflex centers are unimpaired, is put into a basin of cold water, it will at once jump out, but if the water is tepid when the frog is put in, and then cooled gradually, the frog will not move, because the sudden cold is necessary for the nerve stimulation essential for the production of reflex action. The colder the water, the quicker and stronger the reflex action produced in the frog, and when baths were first used in the treatment of fever, it was thought that the colder the water, the greater would be the physiological reaction, but it was found that very cold water produced shivering and consequently resulted in increased heat production, which interfered with proper reaction.

tic diathesis—on account of the weakening influence of the uric acid on the system; (5) a low temperature of the skin; (6) aversion to cold applications; (7) extreme nervous irritability; (8) nervous prostration or exhaustion—this interferes with reaction because of the weak condition of the nerve centers upon which prompt reaction depends.

Application of Knowledge of the Action of, and Reaction from, Cold on the System.[1]—(1) The ward or room in which the bath is given must be warm. (2) If the patient is very old or very young, or if any of the various conditions which interfere with reaction are present, friction is given before the bath and the skin thus made warm,[1] unless, as is sometimes the case, the doctor orders the cold bath to be preceded by a hot one. (3) Except in fever, the bath is continued only for a few minutes, but when continued for any length of time, as is usually the case in fever, friction is given continually during the bath, to keep the blood as much as possible in the skin and muscles and thus prevent shivering and, consequently, increased heat production; a hot-water bag is kept at the feet during the bath, if the patient is in bed, because the feeling of warmth thus induced also helps to prevent shivering. (4) After the bath, unless the patient is not confined to bed and can exercise, friction is given to hasten reaction; also, a hot drink is given

[1] When a patient's pulse is weak and rapid, the circulation of the blood in the small capillaries of the skin is sometimes so poor that the patient complains of cold even when the temperature is high. When this condition exists, the application of cold is likely to produce shivering unless friction is given before the bath. Friction, however, by improving the circulation of blood in the skin vessels, tends to prevent shivering.

and a warmed blanket is put over the patient. This blanket is left on longer when conditions exist which interfere with prompt reaction.

Good Effects that may be Expected from properly Given Cold Baths or Packs.—The most important benefit of the cold bath to the healthy individual is, perhaps, the training of the system to react promptly to cold, and in this way prevent congestion following exposure to cold winds, draughts, etc., and the consequent so-called *cold*. Small children should be gradually accustomed to cold baths, but care must be taken when giving them such baths to provide all the conditions which induce speedy reaction. Cold applications of various kinds are often used in the treatment of nervous disorders and as systemic conditions which interfere with speedy reaction are then present, care must be taken to eliminate all others and to employ every means possible to secure reaction. One of the most common therapeutic uses of cold is the relief of the conditions existing in hyperpyrexia. Some of the more important of these are: (1) Congestion of the blood in the internal organs and poor circulation in the superficial vessels—one reason for these conditions is that the larger blood-vessels are situated in the thoracic and abdominal cavities and in the internal organs, and are directly continuous with or branching from the main artery, the aorta. It is, therefore, only natural that when the heart-beat becomes rapid and weak, the blood should have a tendency to collect in these vessels and not to pass as readily as usual through the many superficial vessels, some of which are as small in diameter as the finest hair. (2) The glands of the skin are abnormally inactive. (3) The mental con-

dition varies in different diseases and in different individuals, but it is usually more or less abnormal. The characteristic state in some diseases is that of stupor, as in typhoid, and in others, delirium of a restless, excited type; and, in all diseases, individuals who have been addicted to the use of too much alcohol have a tendency to develop a restless, excited form of delirium while running a high temperature. In consequence of the effect of cold upon the nervous system, restless delirium is usually quieted and stupor lessened.

Effect of Improvement of Circulation upon the Temperature.—When the blood is made to circulate more freely in the skin there is likely to be more or less loss of heat by radiation. Occasionally, however, the temperature is not much affected, but if the pulse and mental condition are improved by the bath or pack, the principal purposes of the treatment have probably been accomplished. In fact, it is now thought that unless the temperature is very high, 104° F. and over, or remains high for a long time, its reduction is not of such great importance so long as the other conditions are relieved.

Bad Results that may Occur in Treatment by Cold Applications.—When cold baths are of any duration (15 or 20 minutes) unless friction is given, shivering is almost sure to occur. This will result in excessive heat production and increased congestion of the internal organs, the very conditions which it is the purpose of the treatment to relieve. Occasionally, the shock induced by the sudden cold application is more than the patient can stand and the pulse becomes weaker and more rapid; the pulse must, therefore, be felt frequently during the bath. It must be remem-

bered, however, that the primary effect of the cold is to contract the blood-vessels so that just at first the pulsation in the radial artery may not feel as strong as before the application of the cold. If, however, in spite of friction, the patient shivers, becomes blue, and the pulse continues poor, the treatment should be discontinued until the doctor has been notified. In the treatment of typhoid patients, great care must be observed in lifting or turning them as, otherwise, hemorrhage or perforation will almost surely result. Also, it may be mentioned here, that nurses risk injury of their own backs unless they lift patients into and out of the tub properly—see page 303.

Different Methods of Applying Cold for Therapeutic Purposes.—The more common methods of using cold are: The bath; pack; spraying or douching, both internal and external; the application of ice-bags; iced water-coils; or cold compresses.

The Physical Properties of Water which Give it its Cooling Power.—The two principal properties of water which give it its value as a cooling agent are: (1) Its power of absorbing and transmitting heat. (2) The ease with which its physical nature can be changed; *i. e.*, it does not take a high degree of heat to vaporize water nor a very low degree of cold to make it solid. The evaporation of sweat from the surface of the body is one of nature's ways of bringing about the continual loss of heat from the body that is essential on account of the constant production of heat that is taking place within it. The loss of heat from evaporation occurs because the heat necessary to cause the evaporation is taken from the body. When sponge baths or packs in which the body is surrounded by a wet sheet that is exposed to the air are given, a greater

amount of water is provided for evaporation than usual, and consequently more heat is lost from the body. In giving such treatments, it is very essential to hasten reaction, so that there will be a large amount of blood in the skin, both to keep the latter warm and to expose as much blood as possible to the cooler temperature of the water. This is done by means of friction. In both cold packs and baths, heat is taken from the body; also by absorption this can be easily realized when it is seen how quickly the wet sheets become heated. In some forms of packs, the wet sheet is covered by a blanket and in such case, evaporation does not take place so quickly and the heat-absorbing power of water is then the principal agent in cooling the body surface. In the tub bath, evaporation cannot take place and the cooling process is dependent principally upon heat absorption. In all forms of packs and baths in which the temperature is lower than that of the body, heat may be lost also by radiation.[1]

Action of Heat

Factors Influencing the Physiological Action of Heat.—The action of heat upon the body depends upon its mode of application, the degree of temperature, the duration of the treatment, and the extent of body surface subjected to the heat.

Physiological Effect and Uses of a Moderate Degree of Heat.—Heat is a stimulant; it is, in fact, one of the most powerful of all vital excitants; *e. g.*, the heat of the sun is the direct source of all vegetable and animal life. For this reason, if the body temperature falls below normal or if an individual is suffering

[1] See page 251.

from shock, one of the first and most essential parts of the treatment will be to surround the body with a moderate degree of heat. By a moderate degree of heat in such instance is meant about 96° F. As a rule, it is not well to raise the temperature of the air surrounding the patient above the normal temperature of the body, as it is not desirable under such conditions to induce an unusual amount of perspiration nor, after the body temperature has reached normal, to interfere with heat radiation[1] from the skin. The objections to doing so will be seen on pages 293-294.

Exposure of the body to a moderate degree of heat is one of the common methods of treatment in nervous irritation and in nervous exhaustion. For this purpose, heat is usually obtained in the form of baths and packs—these are generally spoken of as sedative baths or packs.

Sedative Baths and Packs

Temperature.—The temperature of the so-called *sedative bath* is usually just below body temperature, 90° to 96° F. It must not be quite that of the body or the elimination of heat by the skin will be interfered with, and as such baths are often continued for hours, and even days, this would be very harmful. The temperature of packs is usually required to be lower than that of baths, 75° to 85° F., because when packs of this nature are given, evaporation of the water is, as far as possible, prevented and consequently the temperature of the wet sheets covering the body soon becomes raised by the heat of the latter.

[1] See page 251.

Effect of Sedative Bath.—When the body is immersed in water with a temperature only very slightly below that of itself, it is surrounded by a non-irritating medium and thus irritation of the cutaneous nerves such as is present at other times, due to clothes, changes in the temperature of the air, force of movement, etc., ceases. As a result, the nerve centers are at rest and are afforded an opportunity to accumulate a store of nutritive material and energy. Consequently sleep may be induced and the regeneration of nervous tissue is favored.

Harmful Effect and Means of Obviating.—The continued use of the sedative bath renders the system very susceptible to the influence of cold. This, however, can be prevented if the warm bath is taken at night and a cold one in the morning.

Use of Sedative Bath, etc.—Sedative baths are used principally to quiet nervous irritation and excitement and, in connection with cold applications, as nerve tonics. Also they are used in the treatment of burns and of certain skin diseases.

Physiological Effect of Applications of a Higher Temperature than the Body.—Some of the more important effects of surrounding the body by an atmosphere with a temperature higher than itself are:

(1) Prevention of loss of heat by radiation and, if much moisture is present, by evaporation of sweat.

(2) Dilation of the superficial blood-vessels with consequent influx of blood to the external parts of the body and lessening of the amount in the viscera.

(3) Muscular relaxation.

(4) Profuse perspiration.

(5) Expansion and softening of white fibrous tissue.

Causes of Death by Heat.—Though heat is a stimulant, if the body is surrounded by a temperature much higher than itself for any length of time, death will result, death in such case being due chiefly to (1) an accumulation of heat within the body; (2) to muscular relaxation.

Causes of Heat Accumulation.—Heat accumulates within the body because, as already stated, when the body is surrounded by a temperature higher than itself, heat cannot pass from it by radiation and when the surrounding medium is moist, as well as hot, the accumulation takes place much more rapidly, because loss of heat by evaporation is then prevented. So long as this is not the case, the excessive perspiration induced by the heat to some extent makes up for the failure of the body to lose heat by radiation. It is for this reason that sunstroke or heat prostration is so much more common on days and in places where the air is full of moisture as well as hot.

Cause of Muscular Relaxation and its Effect upon the Heart.—A high degree of heat continued for more than a few seconds depresses the nerve centers from which the nerves that stimulate the muscles to contraction arise, and consequently the muscles, both those which cover the skeleton and those of the heart, blood-vessels, and other viscera, lose their normal degree of tonicity or contraction and become more or less relaxed. In consequence of this relaxation, the heart does not contract properly and may even stop working. For this reason it is most important to feel a patient's pulse frequently while she is in a hot pack or bath, and, if the pulse becomes very weak and rapid, to discontinue the treatment until the fact has been reported to the physician.

When Muscular Relaxation is Desired.—In certain diseases and following accidents excessive muscular contraction takes place. Familiar examples of such contractions are: (1) the violent involuntary contractions known as convulsions; (2) constant over-contraction of a muscle that often occurs as the result of injury or overuse.

Action of Heat upon the Vasoconstrictor Centers.—These are: (1) stimulation; (2) depression. On account of these effects, when a person is first put into a hot bath or pack the blood-vessels of the skin become contracted and those of the brain and other viscera congested. Later, the vasoconstrictor centers become depressed and the superficial blood-vessels consequently dilate so that a larger amount of blood goes to the surface of the body and the supply in the viscera becomes depleted. On account of this action of heat, it is well to put an ice-cap on a patient's head a short time *before* putting her in a hot bath or pack, that the cerebral blood-vessels may be contracted before the heat is applied and an influx of blood to the head and consequent headache prevented. The contraction of the blood-vessels is due to reflex action; the cold, it is thought, does not penetrate the bone.

Conditions in which the Action of Heat on the Blood-Vessels Is of Special Value.—Three of the most important conditions which the action of heat on the blood-vessels is utilized to relieve are: (1) congestion; (2) what is really an intensified congestion—inflammation—see page 213, and (3) arterial tension. Congestion is characterized by an abnormal amount of blood in the affected part and, as has been previously stated, if there is only a certain amount of blood in the body and a larger proportion than usual

is taken to the skin, the congested portion will be relieved. It is to relieve eongestion that hot baths are given to prevent a eold after the body has been chilled, the ehilling eausing eongestion in some part of the body, and so rendering the part vulnerable to the action of the bacteria whieh eause eolds. Other aetions of heat in relieving inflammation will be discussed on page 395. Exeessive arterial tension is due to an over-eontraetion of the arterial walls and heat overcomes this partly through its relaxing effect on the muscles and partly by depression of the vasoconstrietor centers. Relief of the eondition will be shown by the pulse beeoming more eompressible. In the treatment of nephritis, this result of a bath is often of almost as mueh importance as indueing free perspiration.

Causes of Increased Perspiration.—Inereased perspiration is due to (1) the stimulation of the nerve centers eontrolling the sweat glands, and (2) the increased amount of blood in the skin.

Reason for Inducing Perspiration.—The most common reason for inducing perspiration is to cause an inereased elimination of waste matter from the body. This is more espeeially important when the kidneys are diseased. When the latter organs are functioning properly, very little of the nitrogenous waste matter of the body is exereted by the skin, but, when the kidneys do not excrete it, a large amount will pass off through the skin if exeessive perspiration can be indueed. Another reason for indueing perspiration will be diseussed in the paragraph on reduetion of temperature.

Degree of Perspiration that may be Induced and Effect upon the System.—Ordinarily, the

amount of water that leaves the body through the skin is about two pints in the twenty-four hours or one ounce per hour. This is evaporated so quickly that it is not perceived, and is therefore known as *insensible perspiration*. Hot baths and packs may increase this amount to more than an ounce a minute. This loss of water has a depressing effect upon the heart and it affects the tissues in somewhat the same manner, but, of course, to a much less extent, as hemorrhage. Hence the necessity of having the patient drink as much water as possible, before, during, and after the bath, except when the patient has edema, in which case it may be necessary to curtail the amount of water for fear of increasing the fluid in the tissues.

How Heat is Utilized to Reduce Body Temperature.—Much has been said in the preceding pages of the thermic-producing effect of heat, but if a hot bath is discontinued as soon as perspiration is induced and before the body has become affected by the prevention of heat elimination, the body temperature may be much reduced by the evaporation of the excess amount of perspiration upon its surface and, also, there will be an extra amount of heat lost by radiation on account of the excess quantity of blood near the surface of the skin.

Temperature and Duration of Hot Baths, etc.—It is possible to stand a very much higher degree of temperature with dry heat than with moist heat. One reason for this is that with dry heat only one avenue for the elimination of heat is shut off. Thus, the usual temperature of hot air baths is between 120° and 170° F. and the temperature of a hot water bath or pack is seldom allowed to exceed 112° F. Water can be hotter, however, when it is used in the

form of a spray or douche and the water drained off, because in such case the body is not surrounded by the water. Water 120° F. is often used for this purpose. A hot bath is not continued longer than fifteen or twenty minutes.

Purpose, Effect, and Temperature of Local Hot Baths and Packs.—Local hot applications are most commonly employed for (1) the relief of congestion and inflammation; (2) the softening and expansion of the white fibrous tissue of which the ligaments entering into the formation of the movable joints is largely composed, and (3) to relieve muscular contraction. A much greater degree of heat can be used for partial than for general hot applications, because the prevention of heat elimination from a small part of the body will not make much difference to the general body temperature. Moist applications, however, cannot be used as hot as dry. The usual temperature for partial hot air packs is between 250° and 300° F. Not only can local baths be hotter, but, also, they can be continued for a much longer time than general baths. Thus, to soften the fibrous tissue and relax the muscular tension often existing in stiffened joints, exposure to heat is continued for from twenty to thirty minutes, and for the relief of inflammation the time of exposure is often extended to an hour and more. The good results that follow this treatment of inflammatory conditions is largely due to the excess amount of blood that is brought to the part, this providing a greater number of leucocytes to combat the bacteria.

Light Baths

Difference in Rays.—As regards their action,

rays of light are of three kinds; viz., luminous rays, heat rays, and chemical rays, and the three sets of rays may be separated by the employment of different colored glass. Red glass, for instance, gives passage to rays almost wholly thermal in character; violet and blue glass permits only chemical rays to pass through; yellow and green will allow the passage of luminous rays and, to a slight extent, heat and chemical rays. Being able to separate the rays in this way is of value in therapeutics; for, sometimes, it is wanted to shut out either the heat or chemical rays from a patient and this can be readily done by use of glass of the color that the rays it is desired to obstruct cannot penetrate.

Bad Effect that Chemical Rays may Have.—Too long exposure to the effect of chemical rays may cause a painful form of erythema that resembles a burn in appearance and hence has been erroneously called *sunburn*. But that this is an erythema due to the chemical rays, and not a burn caused by heat rays, has been proved by the use of colored glass, for if a red glass screen is used and the chemical rays thus shut out, no burn occurs, but if violet or blue glass is used and the chemical, but not the heat rays, permitted to enter, erythema results.

Value of Chemical and Heat Rays.—It is to their chemical and heat rays that the curative effect of the sun and electric light is due, and these are the most important promoters of all vegetable and animal life and energy. That the electric light acts as a true vital stimulus is shown by the fact that its use in a greenhouse at night causes the plants to make increased and vigorous growth, and such things as lettuce, radishes, etc., have been made ready for mar-

ket in about a third less time than is ordinarily required for their growth.

Value of Electric Light over Other Methods of Securing Heat.—Nowadays, electric light is used in therapeutics much more frequently than the sun's rays and in many instances its use is preferred to that of any other method of obtaining heat; for one reason, when desired, the doors of the bath can be left open and the air surrounding the patient thus prevented from becoming heated above body temperature. The elimination of heat is thus not only not prevented, but encouraged, and at the same time the heat rays penetrate the tissues almost more thoroughly than heat procured in any other way, and vitalize and energize sluggish metabolism and diseased parts and increase the elimination of waste matter through the skin by inducing perspiration.

Methods of Giving Baths and Packs

Cold Baths

The Brandt Bath.—The tub bath, as a treatment in fever, was introduced into Germany by Brandt in 1861, hence its name—but in this country it did not come into common use for such purpose until about 1890.

The articles required for the giving of a tub bath are:

(1) The tub about half full of water of the required temperature. The doctor orders the degree of temperature; it is usually about 75° F., but it is sometimes lower for individuals of good physique and neither very young nor very old, and it is often higher for frail or elderly people and young children.

(2) A stretcher—those in common use are made of

strong webbing, one inch in width and so latticed together as to leave open spaces two or three inches square, and on either side there is a doubled strip of canvas through which poles can be run. If there is no stretcher, a stout binder of muslin about half a yard wide should be fastened across the head of the tub to provide support for the patient's head and shoulders.

(3) A rubber ring or air pillow to put under the head.

(4) Non-absorbent cotton, to put in the patient's ears, to prevent their becoming filled with water.

(5) A bath thermometer.

(6) A basin containing two or three moderate-sized pieces of ice which can be used to lower the temperature of the water if it becomes too high during the bath.

(7) An ice-cap or, instead, two gauze compresses for the head. These can be cooled on the ice, one being kept on the ice while the other is on the forehead. They should be changed every two minutes.

(8) A binder to put around the patient's loins.

(9) Safety pins.

(10) A rubber sheet to protect the bed.

(11) Two cotton sheets.

(12) A towel.

(13) A hot-water bag and cover.

(14) A blanket.

Procedure.—The tub is brought to the patient's bedside, and if there is no stretcher, as previously stated, support for the patient's head and shoulders must be provided by pinning a binder across the head of the tub.[1] The binder must be stretched tightly at

[1] The top edge of nearly all tubs extends beyond the tub and if there are no handles or hooks on the outside of the tub to which

the top, where the patient's head will come, and allowed to sag under the shoulders, so that the chest will be submerged in the water. Pin a binder around the patient's loins, insert some cotton in her ears, remove the nightgown; put the stretcher under the patient as you would a sheet; run the poles into the stretcher, through the folds provided for them; take the poles at one end and have some one else do likewise at the other, and lower the patient into the tub, resting the poles on the hooks. Put the ice-cap or cold compresses on the patient's head and begin to give friction at once—there should be two people to give friction, and, after a few seconds, the nurse rubbing the lower part of the body can stop for a few minutes and arrange the bed. The mattress should be turned once a day. During other baths, it is only necessary to tighten the under sheet and to spread a rubber sheet over the bed, and, on the half farthest from the bath, a cotton sheet over the rubber one. A hot-water bag, tied securely in a flannel cover, is placed at the foot of the bed under the rubber. During the bath, watch the patient's condition. As has been previously stated, the pulse may become more rapid for a time owing to the shock to the nervous system, and it may appear weaker on account of the contraction of the superficial arteries, but if these conditions do not improve after the patient has been well rubbed, and if she shivers and becomes at all cyanosed, she should be removed from the bath and the doctor notified. Except in emergency, before removing the patient,

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the binder can be pinned, a strong cord or bandage can be tied around the tub and the binder pinned to this. The binder will keep the cord from slipping down and the extended rim will prevent it from slipping up.

to prevent exposure, stretch a sheet across both bed and tub, tucking one end under the mattress and pinning the other either to the stretcher hooks or to a bandage or cord tied around the tub. Unpin the binder, and leave it in the tub. Raise the stretcher, hold it above the tub for a second to drain off the water, rest the stretcher on the side of the bed, remove the pole, and draw the patient on to the sheet that is covering one half the rubber, cover her with the other half of this sheet, remove the sheet that was stretched across the bed, dry the patient by rubbing over the sheet and with a towel, cover her with a blanket and turn her slightly to remove the rubber and cotton sheet. At the same time, slip part of the blanket under her. Put the hot-water bag near, but not against, her feet, draw up the covers, give her a hot drink—broth or beef tea is usually given at this time, never milk, since milk becomes a solid in the stomach and after the bath there may not be sufficient blood in the stomach for the manufacture of the digestive juices necessary to digest it. If the patient shivers, rub her over the blanket for a short time. Remove the blanket as soon as the patient ceases to feel cold.

Lifting without a Stretcher. — When no stretcher can be obtained, if the patient is at all heavy, it requires three people to lift her into and out of the bath. One grasps her under the arms, another takes the legs midway between the knees and ankles, the third passes one arm under the waist and the other under the upper part of the thighs. Before attempting to lift her from the bed, draw her to the extreme edge of the latter and tell her to hold herself as stiff as possible. The greatest care must be exercised in lifting typhoid patients, as hemorrhage or perforation

can easily be caused. In fact, the danger is so great that the Brandt bath is not now used in the treatment of typhoid as much as it was a few years ago, the bed tub-bath, sponge bath, or cold pack being preferred.

A Bed Tub-Bath or Spray Bath

METHOD OF MAKING A BED TUB-BATH.—Put together, so that they can be passed under the patient at the same time, a rubber the size of the bed, not larger, a *small* sheet,[1] a rubber sheet large enough to extend half a yard on either side beyond the small one, and into a pail set on the floor at the foot of the bed. In the center of this rubber, unless the patient is so ill that she will not notice its omission, place a long towel or binder to prevent the shoulders and thighs coming in contact with the rubber, roll or fold these as you would a sheet, before you begin to prepare the patient for the bath. The water for the bath is sometimes brought to the bed in pails or pitchers and poured from these over the patient, but by far the better method is to have a large pail of water the desired temperature, and a bath spray, or, if this cannot be had, a piece of rubber tubing with a funnel in one end and the spray of a small watering-can in the other. If there is no regular stand to place this pail on, so that it will be about two feet above the patient, a stool can be stood on a table. The water is made to run by siphonage. The way in which siphonage is started depends upon the kind of spray used; if it is a

[1] It is important that these are not larger than necessary, or the roll will be too bulky to pass under the patient. They are sometimes omitted, but when possible it is well to use them as it obviates all danger of wetting the bed, either during the bath or when removing the top rubber.

bath spray, the metal piece for screwing to the bath faucet will probably interfere with the insertion of a funnel, but siphonage can be obtained by pouring water into the tube from a pitcher. When doing this, make pressure on the tube at the end to which the spray is attached, because to get siphonage the tube must be filled with water. When it is, plunge the end into which the water has been poured into the pail of water. If a funnel is used, no pitcher is necessary because the tube can be filled by filling the funnel and letting the water run into the tube, the far end of which must be constricted until the funnel is inverted in the water and while putting the funnel in the water the spray end must be held lower than the pail. Another important point to remember is that the funnel must have some water in it when it is put into the pail. Two conditions likely to interfere with siphonage during the bath are: (1) pulling the funnel above the water; (2) allowing the tubing, if it be soft, to become bent on the edge of the pail.

Procedure in Giving the Bath.—Remove the top covers, except the sheet, pass the rubbers, etc., under the patient, place a towel over her under the sheet. This will do instead of a loin binder, except for a male patient. Place the hot-water bottle at her feet, and as it cannot be covered, it must not be *really hot;* put the ice-cap or cold compresses on her head. On either side the bed, tie one end of a piece of fine rope to a bar at the head of the bed and the other end to the foot of the bed. The ends at the foot should be tied nearer to each other than those at the top of the bed. Put the side edges of the rubber over the rope as in Fig. 19. If the rubber is narrow, it will be necessary to secure it to the rope with clothespins or

to sew a few pieces of tape to its edge and to tie these to the rope. At the foot of the bed, bunch the rubber up somewhat, so that the water will not run out too quickly; pass the free end of the rubber between the bars[1] of the bed and gather it into a pail—it should

Fig. 19. Spray Bath

extend into this about four inches; if it is too long, it will be in the way; if too short, it may be pulled out. If the rubber is not long enough, use two rubbers, slipping the second one about four inches *under* the

[1] If, as is often the case in hospitals, the bars at the foot of the bed are too low to raise the rubber sufficiently, two narrow stiff splints with a hole in their upper end can be tied securely to the low bars and the rope passed through the holes and tied, or, instead of using rope, rolled blankets or pillows can be placed along the sides of the bed under the rubber.

other at the foot of the bed. Place a rubber under the pail on the floor; raise the head of the bed on shock blocks; arrange the stand and pail of water in position. If possible, have an assistant remove the upper sheet and give friction over the patient's body while you start siphonage. If you cannot get help, do this yourself before starting siphonage. Hold the spray in one hand and move it so that the water will fall all over the body; rub the patient with the other hand. It is always well to have help in giving such a bath, as the friction can then be so much more thorough. Friction consists in passing the hand or hands rapidly back and forth over the skin, keeping the wrist loose while doing so, that your stroke may be rapid and not too heavy. Heavy friction, after a few baths, may cause irritation of the skin. Pass your hand under the patient's back, every once in a while, and rub it. Toward the end of the bath, turn the patient slightly on her side and spray and rub her back. The doctor orders the length of time he wishes the bath to last—the usual time is between ten and twenty minutes. To remove the bath, drain the water off as well as possible, let down the sides of the rubber, wipe it, remove it to do this—have help, if possible—turn the patient slightly on her side and roll the rubber under her; draw or turn her over on to the sheet; roll the rubber up on the other side, then fold it down from the top,[1] wrap the sheet about the patient and remove the towel covering her; dry her by rubbing over the sheet, cover her with a blanket, and turning her slightly on one side, slip the extra sheet and rubber

[1] The sides of the rubber are rolled up in this way to prevent any water that may be in it getting on to the bed or floor.

from under her, and at the same time pass one end of the blanket through. The after-treatment is the same as for the Brandt bath.

Sponge Bath

For a sponge bath there will be needed:

1 rubber sheet.

1 very small cotton sheet or bath towel.

2 towels.

. 1 loin binder and, for a male patient, safety pins.

1 large wash cloth.

1 hot-water bag and cover.

1 foot tub half full of water of the required temperature, usually between 70° and 80° F.

1 bath thermometer.

1 basin with a few small pieces of ice—to lower the temperature of the water if required.

1 ice-cap or 2 compresses of gauze for the head—they can be cooled on the ice.

1 blanket.

Procedure.—Remove the top covers except the sheet, pass the rubber sheet, with a large towel or small sheet in the center, under the patient. If the patient be a man, the orderly pins the binder around the pelvis; if a woman, cover the pubic region with a binder, leaving it longer on one side than the other, so that when the patient is turned during the bath, the binder will fall behind her; place the ice-cap on her head and the hot-water bag at her feet; remove the sheet.[1] Give light friction for about two minutes,

[1] In giving these baths, it is required to expose the body as much as possible, as evaporation and hence cooling the skin will then take place more quickly, but, if the patient is likely to object,

then begin sponging. Have plenty of water in the wash cloth and squeeze it over the body as you wash, using a sweeping, downward stroke.[1] As in the giving of all cold baths, it is better to have an assistant, because then the friction can be continuous. If, however, you cannot get help, sponge with one hand and rub with the other, and periodically stop the sponging and give friction for a minute. The friction is given as previously described, page 307. Mop the water from the rubber with the wash cloth, from time to time, and, by squeezing the latter, return the water into the tub. This will probably raise the temperature of that in the tub and it may be necessary to put a piece of ice in for a time—do not let the patient see you doing this. While giving the bath, keep the patient's arms away from her side and sponge the axilla frequently. Sometimes a cold compress is kept in each axilla, but many patients object to this and it does not seem to make any difference in the effect of the bath. When removing the rubber, observe the precautions described in connection with bed tub-baths. The treatment after the bath is the same as that following a tub bath.

Alcohol Baths.—Sometimes it is not advisable to turn or move a patient as much as is required to put a rubber sheet under her, and an alcohol bath is

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a large towel can cover her legs while the upper part of her body is being bathed, and then drawn over her chest before the legs are bathed.

[1] A common error in giving such baths is to take an upward stroke with the idea that it helps the venous circulation. In reality, the pressure made with the sponge is not deep enough to affect venous circulation, and as it rubs against the hairs it often produces irritation of the skin.

then given; because alcohol evaporates so rapidly that a small amount will cool the surface of the body. The alcohol is usually used in a strength of 25 per cent. One pint will be sufficient.

PROCEDURE.—Protect the bed by placing a bath towel on either side of the patient and one under her legs. Proceed in the same manner as when giving a sponge bath, with two exceptions: (1) Keep the sponge but slightly wet. (2) Instead of sponging the patient's back, rub it with your hand, without turning the patient, first wetting the hand with alcohol. Some doctors prefer that the patient be sponged with hot water, 106° F., before the alcohol is used. This can be done without using enough water to wet the bed.

Cold Packs

The following are but a few of the many ways of giving cold packs. In Methods 1 and 3 rapid evaporation is the chief action depended upon for cooling the body surface. In Methods 2 and 4 it is the absorption of heat by the water that is relied upon, but in the former methods absorption also will take place and in the latter, evaporation, but more slowly.

METHOD 1.— Bring to the bedside:

(1) A foot-tub full of water; the temperature usually ordered is between 70° to 80° F.

(2) A bath thermometer.

(3) A rubber sheet.

(4) 2 small cotton sheets.

(5) An ice-cap or gauze compresses and ice.

(6) A hot-water bag in its cover.

(7) A whisk.

(8) A blanket.

FIG. 20.—WRINGING SHEET FOR COLD PACK

(9) 2 towels.

(10) 1 binder.

Method of Giving Pack.—Open the sheets and gather each one up loosely, lengthwise, and put them in the water; remove the top bedcovers except the sheet, pass the rubber sheet under the patient, place the hot water at her feet and the ice-cap on her head; place the binder across her pelvis; wring out both sheets; pass one under the patient; remove the dry sheet covering the patient and replace it by the second wet one; carry the ends of this under and around the patient's arms and bring the corners over her shoulders; put it between the legs. Keep the patient's arms away from her side and her legs apart. Every part of the body except the head and the soles of the feet is thus covered with the wet sheets. If the patient shows no tendency to shiver, the hot bag at her feet can be dispensed with until after the pack and the wet sheets are brought around her feet. As soon as the sheets are in place, start giving friction and continue to do so at intervals during the bath. Wet the sheet by shaking water upon it from the whisk. It must be kept quite moist throughout the time that the pack is continued; this is usually about fifteen or twenty minutes.

The treatment following a pack is the same as that after baths.

METHOD 2.—The articles required for this pack will be the same as for that of Method 1, minus the whisk and plus a second blanket.

To Give the Pack.—Arrange the sheets for the pack as in Method 1 and put them in the water; pass the rubber sheet covered with a blanket under the patient; place the ice-cap on her head; arrange the wet

sheets as described in Method 1; then bring one end of the blankets around the body and under cover of this give friction for about one minute; tuck the blanket firmly in under the side; bring the corner down over the shoulder and fold it so that the blanket will fit snugly around the neck. Arrange the other side of the blanket in like manner and tuck it under the feet. The success of the pack depends upon the exclusion of air from under the blanket. Place the hot-water bag at the feet. If the pack is intended to allay nervous irritation, another blanket, folded lengthwise, is placed over the patient and tucked under her shoulders sides, and legs and the pack is continued for two or three hours. The patient may complain of cold or even shiver during the first ten minutes, but if she does not feel warmer at the end of that time, the fact should be reported to the doctor.

When the pack is given as an antipyretic, the second blanket is not used, and the wet sheets are usually changed as often as they become heated; this will, of course, always happen more rapidly when the body temperature is high. Friction should be given for about a minute each time the sheets are changed.

The treatment after the bath is the same as in Method 1, with the addition, as a rule, of rubbing the body with 50 per cent. alcohol.

METHOD 3.—This method is used when the patient is not to be turned and the wet applications are made to the anterior surface of the body only. To give such a pack there will be needed:

1. A large basin or foot-tub containing water the temperature that has been ordered, which is usually between 68° and 75° F.

2. Three bath towels.

3. Several cotton or linen towels, the number depending upon their size; usually seven or eight are required.

4. A bath thermometer.

5. A basin with a few small pieces of ice.

6. An ice-cap or ice compresses.

7. A hot-water bag.

8. A binder.

Prepare the patient as for an alcohol sponge; wring the towels fairly dry, put them around the arms and legs and over the chest and abdomen. Have an extra towel in the water with which to start changing those on the body. Change them in turn, one every minute, and rub the body, over the towels, between times. The rest of the treatment is the same as for Method 1.

METHOD 4. *Cold Pack for the Chest.*—The articles necessary for this pack are:

1. A small rubber.

2. A folded sheet.

3. A nightingale or small blanket.

4. A chest binder of doubled flannel, cut according to the directions on page 484.

5. Four thicknesses of muslin cut to fit the posterior chest and a like number for the anterior.

6. Safety pins.

7. A basin of water the required temperature—usually between 75° and 80° F.

To Give the Pack.—Remove the nightgown; cover the chest with the nightingale; pass the rubber covered with the sheet under the patient's shoulders; do likewise with the flannel binder; wring out the muslin compresses and pass one—the four thicknesses—under the back and place the other one upon the chest; draw up the sides of the binder; pin the back

and front sides of each shoulder together, with the ends overlapping so that air will not be able to enter; pin the fronts together. These also must overlap; they must not, however, be pinned tightly enough to hinder the respiratory movements. Tuck the nightingale behind the shoulders. The whole procedure should be carried on under cover of the nightingale. If the patient seems inclined to shiver, put a hot-water bottle at her feet. The compresses are changed according to the doctor's order; in some instances the treatment is continuous and the compresses are changed every hour; in others, they are changed about every fifteen minutes for a given number of times, and the treatment then discontinued for three or four hours.

Sedative Baths

A sedative bath, as previously stated, is often continued for some time, and if the patient is weak, some contrivance is necessary to keep her comfortable. A stretcher, such as described on page 300, covered with a cotton blanket, or a hammock, likewise covered, can be used. The hammock can be kept in place by passing a cord through its meshes on either side and under the tub. A binder to support the head and shoulders can be arranged as described on page 302. An air cushion or ring will be needed for the head. A folded cotton blanket with several loops of strong tape sewn to either side can be substituted for the hammock, the cord being passed through the loops. The tub will need to be covered to prevent the water cooling quickly. To do this, put a few pieces of board across it, cover it with a rubber, and over this place a blanket. Put a small blanket under the

patient's head and pin its lower edge to the top of the first blanket; pin a towel around the patient's neck; suspend a thermometer from one of the boards; fold the end of each blanket around the top or bottom of the tub and pin them; put a towel between the patient's neck and the blanket. If the bath is to be continued for any length of time, cover the blankets with a spread.

The water in the tub must be deep enough to cover the patient's chest. The temperature commonly ordered is between 92° and 96° F. and it must be maintained as uniform as possible. To do so, it will be necessary occasionally to remove some of the water and replace it with hot water.

N. B.—*Always keep your hand between the patient and the stream of hot water.*

Continuous Baths.—Patients with extensive burns or badly infected wounds are often kept in a bath for days, only being removed at proper intervals to allow opportunity for the evacuation of the bowels and bladder, and any treatment that the wounds may require. Twice during the twenty-four hours, while the patient is out of the tub for such purposes, the latter should be scrubbed, disinfected, and refilled. A mild antiseptic, as boric acid, is usually added to the water of baths used for such purposes, and vaseline, or some form of ointment, is generally smeared over the skin to prevent excessive maceration of the latter.

Hot Baths

Different Kinds.—The hot baths in most common use are: the hot-water bath, the hot-air or modified

Turkish bath, the partial hot-air bath or bake, the vapor or modified Russian bath, the electric light bath.

Hot-Water Baths

Purposes.—The more common uses of hot-water baths are to induce perspiration and to relieve muscular tension.

Bath to Induce Perspiration.—The usual temperature of baths for this purpose is between 105° F. and 110° F. The chief points to remember in giving them are: (1) Be sure that the bath is the temperature ordered. (2) Do not go out of hearing distance, and, if the patient is at all weak, do not leave her alone. (3) Do not let her remain in the bath longer than the specified time; this is usually between five and ten minutes. (4) Be sure that the patient is wrapped warmly on the way from the bath to her bed, and that she keeps covered after she gets into bed. If, as is often the case, a hot drink is ordered, give it after the patient is in bed.

Baths to Relieve Convulsions.—These are used more frequently for children than for adults, hot packs being generally easier to use in the treatment of the latter.

The usual order for the temperature is 108° F. to 110° F. While the child is in the bath, support its head and shoulders on your arm, and keep an ice-cap or iced compress on its head. The child is removed as soon as the convulsions cease; if they do not do so within ten or fifteen minutes, the temperature of the water is usually reduced to about 95° F. It may be raised again later if necessary. Mustard is often added to these baths for counter-irritant effect, though

this, on aceount of the high temperature of the water, will be slight—see page 400. To add mustard to a bath, either tie it in a piece of gauze and move this baek and forth in the water until it is dissolved, or else mix it to a paste with cold water and then liquefy the paste by adding hot water to it gradually. The mustard powder must not be put loose into the bath water for it will not mix properly. The usual proportion of mustard is one tablespoon for every gallon of water.

Partial Baths

The Sitz Bath

Purpose.—The sitz bath is used most frequently for the relief of eongestion of the pelvic organs or reetum. The heat, by dilating the superficial blood-vessels and relaxing the tension of the muscles, relieves the congestion and pain.

Method of Giving.—The patient is usually clothed in an undershirt and a loose wrapper, stoekings and slippers. The bath is given in a speeially shaped tub, which allows of the patient sitting in it, but with her feet on the floor and only the upper part of the thighs and the trunk to the waist line immersed in water. The undershirt is turned up as far as neeessary and the wrapper is usually removed and replaeed by a large blanket whieh is fastened at the neek and envelops both bath and patient. The bath is generally continued for from twenty to thirty minutes. The usual temperature is about 110° F.

The Foot Bath

Purpose.—Foot baths are used for the relief of congestion either in the feet or in some other part of

the body, as in the throat, abdomen, or chest. The physiological action which allows of the relief of congestion in a part of the body distant from the point of application will be discussed in connection with counter-irritants—Chapter XVI.

Method of Giving a Foot Bath in Bed.—The articles required are:

(1) A foot tub half full of water, 108° or 112° F.
(2) A large blanket.
(3) A bath towel wrapped about a hot-water bag.
(4) A small towel.

Loosen the upper bedcovers at the foot of the bed; double the blanket and then fold it in four with the two ends on either side the fold; place this at the foot of the bed; take hold of one edge and, also, the bedcovers and fold the latter up to about the center of the thighs; put the upper edge of the blanket under the covers; flex the patient's knees and then turn the end of the blanket that is still at the foot of the bed as far under the legs as the foot tub will extend. Place the tub on the bed at the side of the feet; put your arm that is nearest the foot of the bed across the tub; put your other arm under the patient's legs with your hand supporting her heels; and raise her feet from the bed and at the same time draw the tub into position. Put the feet into the tub slowly; to some people, a temperature of 108° or even 112° F. is not particularly uncomfortable, but others might find it unbearable. When this is the case, lift the feet into and out of the water several times until they become accustomed to the temperature. While doing this, keep your free arm across the tub so that the blanket will not get into the water. As soon as you place the patient's feet in the tub, put the small towel, folded, over the

edge of the latter under the patient's knees, fold the blanket around the tub, and draw down the bedclothes. The feet are usually left in the water for twenty or thirty minutes. After about ten minutes, it may be necessary to add some hot water. To do this, bring some water about 130° F. in a pitcher and pour it

Fig. 21. Foot bath. The blanket has been thrown back to show the manner of holding the legs and feet while putting them into and removing them from the tub, ordinarily they should not be exposed.

into the tub slowly, keeping your hand between the stream of water and the patient's feet.

To remove the feet, fold the bath towel that has been around the hot-water bag and place it on the far side of the bath; put one arm across the bath tub and pass your other arm and hand under the patient's legs and heels; lift the feet from the tub and hold them above it for a few seconds, then place them on the

towel; remove the tub from the bed; wipe the feet and legs thoroughly, draw down the portion of blanket that is under them; put the hot-water bag at a short distance from them, draw down the covers and at the same time the blanket; remove the latter, and tuck in the covers.

Hot Packs

Points to be Remembered in Giving Hot Packs.—(1) The danger of burning the patient—for obvious reasons this is much greater in the use of packs than baths. The more common causes of burns are: wringing out the blankets in water that is too hot, or not wringing them dry enough; placing the hot-water bag next the wet blankets and thus causing steam (it will be seen that in the method of giving a pack here described there are, including the cover of the bag, five folds of blanket between the hot-water bag and the wet blanket). (2) The danger of prostration from causes that have been already described, see pages 89 and 294. (3) The danger of causing congestion in some part of the body either by: (*a*) allowing the entrance of cold air under the enveloping blankets during the pack; (*b*) exposure of the patient after the pack; (*c*) too sudden reduction of the temperature of the surroundings after the pack; (*d*) by not drying the patient properly after the pack, and so allowing evaporation and consequent chilling of the body surface.

To Give a Hot Pack:

(1) Tie an ice-cap on the head.

(2) Replace the top bedcovers with a blanket as described on page 191, leaving the clothes neatly folded at the foot of the bed.

(3) Pass two blankets with a rubber between them under the patient; the rubber should reach her neck, the blankets extend three inches beyond it

(4) Remove the nightgown.

(5) Put a towel between the blanket and the patient's neck and chin.

(6) If the ward is cold, turn the side of the blankets on which the patient is lying over her until you bring in the hot blankets.

(7) Line a foot tub with a rubber sheet.

(8) Put four or five hot-water bags—without their covers—into this and double the ends of the rubber over them so that the rubber will become heated.

(9) Soak two old, thin bath blankets[1] in water about 150° F., leaving one corner of the upper and lower edge of each blanket out of the water. These corners should be diagonally opposite each other as the blankets will then, when stretched, be somewhat on the bias; wring each blanket separately. To do so, have an assistant take one dry corner and you take the other; let each turn the blanket in the opposite direction; *wring the blankets very dry. Wring the larger one first and put it in the hot rubber, against the hot-water bottles, and then do likewise with the smaller one.*[2]

(10) Carry the foot tub and its contents to the bedside.

[1] One of these should be narrow, only about the width of the patient's shoulders.

[2] In some hospitals, wringers made of heavy crash or ticking, with a wide hem at either end through which sticks can be passed, are provided. But many superintendents of nurses object to these because they think it is safer to have the blankets wrung as described above, and another objection is that wringers cannot be had in home nursing.

(11) Pass the small blanket under the patient.

(12) Place the other one over her—under the dry blanket covering her—arrange the wet blanket in the same way as the sheet in the wet pack—page 311.

(13) Fold up the sides of the dry blanket covering the patient, leaving it just wide enough to tuck under her; tuck it under her shoulders, feet, and sides.

(14) Draw up the farther edge of the blanket, on which the patient is lying, across her, tuck it under her

Fig. 22. Manner of folding blanket over shoulders in hot pack.

shoulder and side, making a fold over the farther shoulder so that the blanket will fit snugly around the neck. Do likewise with the other side of the blanket. This must be long enough to tuck in well; turn the blanket under the feet; put the hot-water bags in their covers and place one at the feet and the others along

the sides; fold the rubber over the patient and draw up and arrange the lower blanket in the same manner as the other one; pull up the bedclothes.

While the patient is in the pack, feel her pulse frequently at the temporal artery and, unless there are orders to the contrary, encourage her to drink as much as possible—either water, vichy, or hot drinks, as hot broth or, if it is allowed, lemonade. The usual duration of the bath, if it has no outward effects, is twenty minutes. At the end of this time, fold down the bedclothes to the foot of the bed again, and, under cover of the dry blanket that was folded over the patient, remove the wet blankets and rubber; next, dry the patient by giving friction over the dry blanket and then, under cover of this blanket, wrap the blanket that was under the rubber, around her, folding it in the same manner as before; remove the blanket under which you have been working; place the towel between the blanket and the patient's neck. Leave the ice-cap on the head and a hot-water bag at the feet. Draw up the bedclothes. At the end of an hour, unless the patient is sleeping, dry her by rubbing over the blanket; rub her with alcohol 50 per cent., being careful not to expose her while doing so. This treatment, by exciting nerve impulses, helps to overcome the relaxing effect of the heat on the superficial muscles, blood-vessels, and skin.

Partial Hot Pack.—In the treatment of rheumatism or stiffness of a leg or arm from any cause, a partial pack is sometimes used, when a local hot-air or electric bath cannot be had.

To give this: Place the leg or arm to be treated so that it rests comfortably on a pillow; pass a rubber about a yard square covered with a doubled piece of

blanket under the limb. Put a doubled piece of flannel in the center of a towel and dip this into water about 180° F.; let it become thoroughly saturated with the water and then wring it *very dry* by twisting the ends of the towel in opposite directions; wrap this about the limb, and fold the blanket over it. Sometimes, only one application is made, but, oftener, the pack is continued for an hour or more, and the moist flannel is then changed sufficiently often to keep it hot. After removing the pack, rub the limb with alcohol, and wrap it either in flannel, cotton-wadding, or non-absorbent cotton, so that it will not become chilled. If massage is part of the treatment, it should be given immediately upon the termination of the pack.

Hot-Air and Vapor Baths

In giving these baths the detail of the procedures depends, more or less, on the variety of the bath, or its substitute, used, but the main points are the same in all. These are:

(1) Bear in mind the danger of burning the patient, also the fact that she is likely to become prostrated by the heat.

(2) Take the pulse every few minutes.

(3) Keep an ice-cap on the patient's head not only during the pack, but for some time before and after it. The reason for this has been already discussed.

(4) Arrange the bath so that there will be no escape of heat, and if, for any reason, it is impossible to obtain a sufficiently high temperature in the usual manner, endeavor to raise it by the use of hot-water bags.

(5) Unless liquids are to be restricted, give as much

vichy or hot drinks—such as lemonade, if allowed, and beef-tea—as the patient can take.

(6) Keep the patient rolled in a warm, dry blanket for about an hour after the bath. Dry and rub her vigorously with alcohol before rcmoving the blanket.

(7) Avoid exposing the patient either while taking her out of the bath or the dry blanket.

In many of the larger hospitals, cabinet baths into which the patient can be slid on a stretcher, or which will fit over the bed, are used. But these are expensive, and, unless there is a special room for such treatments or apparatus, cumbersome things for which to find a keeping place. Therefore, in many hospitals that are not equipped with hydrotherapeutic appliances and in houses, hot-air baths are often given in the following manner and require the articles here enumerated:

(1) An ice-cap.

(2) A hot-water bag and cover.

(3) Three blankets.

(4) A towel.

(5) Two large rubber blankets.

(6) Bed cradles, the number depending upon their size.

(7) A bath thermometer.

(8) A hot-air pipe and support.

(9) Asbestos to put around thc top of thc pipe.

(10) A Bunsen burner or alcohol lamp.

In a private house, the elbow of a stovepipe five or six inches in diameter can be substituted for the hot-air pipe, and an old screcn, clothes-horse, or wooden chairs for the bed cradle.

Method of Giving Hot-Air Baths:

(1) Tie the ice-cap on the patient's head.

(2) Replace the top bedclothes with a blanket in the manner described on page 191; remove the clothes and hang them over the screen or back of a chair.

(3) Pass two blankets with a rubber between them under the patient—as in the pack, the rubber should reach the patient's neck and the blankets extend three or four inches beyond it.

(4) Remove the nightgown.

(5) Put a sufficient number of bed cradles over the patient to extend from just below her neck to two or three inches lower than her feet.

(6) Tie the thermometer to the cradle at the upper end.

(7) Cover the cradles with a blanket and this with a rubber sheet. Both blanket and rubber must be long enough to fall over the cradles and to be tucked under the patient's shoulders at one end, under the cradles at the other side, and to reach the feet at the lower end.

(8) Put the hot-air pipe in position at the foot of the bed.[1] It should not be put directly in the center or the hot air will enter too near the feet. It should extend under the cradle about three inches and be at least three inches higher than the feet.

(9) Unless the pipe is covered with asbestos, some of this material must be wound around the part that enters the bed and as much more of it as the clothes are likely to touch. If no asbestos can be obtained, a piece of wet blanket can be substituted. It must be kept wet during the bath.

[1] The hot-air pipe can be introduced at the side instead of the foot of the bed with slight modification in the arrangement of the bedclothes, but unless the bed is wide or the patient slight, the end of the pipe is likely to be too near the patient.

(10) Tie the pipe to the cradle.

(11) Draw the ends of the rubber and blankets that are under the patient up over the cradle and pin the edges of the under blanket together.

(12) Gather the blankets and rubber around the pipe in such a way that there will be no opening through which the hot air can escape.

(13) Do likewise at the patient's neck and arrange these in such a manner that the thermometer can be looked at without undoing the blankets to any extent. Put a towel between the blankets and the patient's neck.

(14) Light the lamp or gas.

(15) Put the bed-covers over the bath.

The temperature usually prescribed is between 130° and 160° F.

The treatment during and after the bath is the same as for the pack.

PURPOSE.—The more common uses of such baths are to induce perspiration and to relieve pain and stiffness due to rheumatism.

HOT-AIR BATHS FOR BURNS.—Continuous hot-air baths are often used in the so-called *open treatment* of burns. The principal points of difference between baths given for this purpose and those already described are: The patient usually lies on a cotton sheet instead of a blanket and the temperature of the bath is not raised above 96° F. These differences entail a few differences in the details of the arrangements.

(1) Instead of arranging the bedclothes covering the mattress in the usual manner, the latter is covered with a large rubber sheet; this in turn is covered with an old blanket and the blanket with a sterile sheet. If there are burns on the under surface of the body, a

folded sterile sheet is usually placed where these will come in contact with the bed.

(2) There will probably not be so many covers needed over the cradles and they are not tucked in except around the pipe and at the foot of the bed; ordinarily, if the required temperature can be maintained without extra covers, there is only a sheet, or a sheet and thin dimity spread, kept over the cradles. The objects of this treatment are (1) stimulation; (2) to keep the skin active; (3) to prevent irritation of the wound by dressings.

Partial Hot-Air Baths or Bakes.—Small hot-air cabinets of various shapes are used for *baking* different parts of the body. These consist of metal boxes of various shapes lined with asbestos. Some are so arranged that they can be heated by gas and others require electricity or electric lights. The method of arranging the part to be baked in the apparatus depends upon the nature of the latter and the part of the body that is being baked. There are, however, certain essentials that are the same under all circumstances. These are:

(1) That the patient be comfortable. The height of the bath must be regulated so that there will be no strain on the muscles of the part that is being baked, and the patient be able to lean back in her chair at ease.

(2) The part to be baked must be protected because it is necessary to become gradually accustomed to the high degree of temperature that is generally used—250° F. to 300° F.; also, even the asbestos becomes so hot that the flesh would be burned if it came in contact with it. Various kinds of protectors are used. Some are made of old blankets, others of canton flannel or of

cotton-wadding stitched between gauze. The protectors that are made to fit the part—*e. g.*, a loose mitten shape for the hand and arm, a stocking shape for the leg—are generally preferred to those that require to be wrapped about the limb. When blanket protectors are used, three will have to be worn, one over the other, and, usually, four canton flannel ones will be required; one padded one will suffice if it contains three layers of cotton-wadding. With all kinds of protectors, extra thickness is required for old people and children, and for parts in which the circulation is particularly poor; also, in such cases, the higher temperature must be used with caution.

(3) Never put pins in a protector; metal becomes so heated in the high temperature that pins will cause the protector to take fire.

(4) In some bakes, there are a few metal nails or clasps and often the floor of the bake is of metal. The protector must not be allowed to touch these. There are asbestos pads to go over any nails that are likely to come in contact with the protectors, and it must be seen that these are in place.

(5) The part to be baked must be perfectly dry.

(6) All rings must be removed from a hand before putting it in the bake.

(7) If it is necessary, as is often the case with new fractures, to retain a splint in place during the baking, a little cotton must be placed between it and the skin.

(8) There must always be a thermometer in the bake while it is in use, and it must be looked at frequently, for the temperature is likely to rise very suddenly and it is excessively dangerous to let it go much above 300° F.

Vapor Baths.—There is a variety of cabinet bath

made of rubber that is much used, both in hospitals and homes, for the giving of vapor baths. To give such a bath: Place an old wooden chair in the cabinet and under the chair place a foot-tub; in the tub put a lighted gas or alcohol stove, and on this a deep open basin of water. Envelop the patient in an old blanket and remove her clothing; have her sit on the chair, place an ice-cap on her head, and close the cabinet. This closes in such a way that the patient's head is the only part of her body exposed to the outer air. While the patient is in the pack, place a rubber cover with a blanket over the bed and wrap the patient in the blanket as soon as she returns to bed. Before she leaves the cabinet for her bed, dry her thoroughly with a warmed bath towel, keeping the blanket around her while doing so. The treatment during and after the bath is the same as for the hot pack.

Electric Light Baths

There are two general forms of the electric light bath; viz., the incandescent-light bath and the arc-light bath. The former is the variety most commonly used. For the giving of electric light baths, special cabinets are required. To prepare the patient for the bath, remove her nightgown and fasten a binder around her loins. The exact details of the necessary procedures cannot be given here, as they depend upon the variety of cabinet used and the nature of the treatment required. If only a low degree of heat is required, the patient is usually left uncovered during the bath except for the binder around the pelvis, but if the temperature is to be raised to any extent, one or more thicknesses of blanket are put over her.

The head is, of course, always outside of the cabinet. The treatment during and after the bath, including the ice-cap on the head, is the same as when hot air is used.

Duration of Electric Bath.—The usual duration of a bath is from fifteen to twenty minutes. Longer exposure is likely to produce exhausting effects, because, even when heat elimination is not prevented, the internal temperature becomes elevated by the penetration of the tissue by the heat rays.

Medicated Baths

Purpose.—Bran, starch, bicarbonate of soda, and sulphur baths are used in the treatment of skin diseases. Mustard, Nauheim, and salt baths are used to produce counter-irritation (see page 394) and so improve the cutaneous circulation and thereby relieve congestion of the viscera and other abnormal conditions.

Method of Preparing Baths

Amount of Water Required.—In these baths, the trunk and extremities should be covered with water. This requires the bath to be between half and three quarters full. An ordinary sized tub when half full contains about 25 gallons—*i. e.*, 100 quarts.

Bran Baths—Method 1.—Boil 1½ pounds of bran in a bag for twenty minutes, drain off the fluid and add it to the bath-water, which should be about 95° F.

Method 2.—Put two or three pounds of bran in a bag made of doubled gauze, and immerse the bag in the bath-water and move it about until the water is a milky color.

Bicarbonate of Soda Baths.—The bicarbonate of soda bath is more especially used to allay itching of the skin. To prepare it, dissolve the soda in the bath-water, allowing eight ounces of soda for every gallon of water.

Starch Baths.—To prepare a starch bath, mix half a pound of starch with sufficient cold water to cover it, and add, slowly, enough hot water to make a paste about the consistency of a thick cream; pour this into the bath-water, mixing the two with your hand as you do so.

Sulphur Bath.—To prepare, dissolve potassa sulphurata (sulphurated potash), known also as *liver of sulphur*, in a small quantity of hot water, and add this to the bath-water. From one to two ounces of sulphur are usually used for a bath, and the temperature of the bath is generally between 85° and 95° F. Sulphur, in addition to acting as a sedative to the cutaneous nerves, stimulates the circulation of the blood in the superficial vessels.

Method of Giving Baths

The patient lies quietly in the bath for from ten to twenty minutes. Afterward she is enveloped in a *warmed* sheet and dried by patting gently over the sheet—never rub hard, for, as these baths are given largely for their soothing effect upon the irritated skin, rubbing will do away with the benefit of the bath.

Mustard Baths

Allow one tablespoon of mustard for every gallon of water. Mix the mustard into a paste with cold

water, thin the paste with the bath-water and pour into the latter. The temperature of the bath is usually about 80° F. Never use hot water if the full effect of the mustard is desired, because the irritating action of the mustard is due to a volatile oil that is dissipated by heat. Sometimes the primary thing desired is heat and the mustard is added because, for a short time, it adds slightly to the irritating effect of the former. In such case, the temperature may be as high as 105°–110° F.

Nauheim Baths

Nature and Purpose.—Preparations of salts can be bought, which will, when dissolved in the bath water, give the latter about the same composition as the water at the famous Kur in Nauheim, Germany. These baths owe their action largely to the irritating effect upon the skin of the chloride of calcium—one of the salts in the preparation—and of the carbonic acid gas which is set free when the salts are dissolved.

These baths are used in the treatment of cardiac, renal, and nervous diseases.

Temperature.—The temperature generally prescribed is between 80° and 90° F.

Method of Giving Bath.—The patient lies quietly in the water the required length of time—about three to five minutes the first day, one or two minutes more the next day, and so on until the maximum time of twenty minutes is reached. After a bath, envelop the patient in a hot sheet and give friction over this until all moisture is absorbed. The patient must not be allowed to exert herself in the least and should rest quietly for an hour or two.

Salt Baths

To prepare a salt bath, dissolve ten to fifteen pounds of sea salt in a tub half full of hot water; allow the water to cool to the prescribed temperature. This is usually about 70° F. Rub the patient while in the tub. Dry her by rubbing briskly over a warmed sheet.

Salt Rubs

In the treatment of nervous patients, salt rubs are sometimes given instead of, or in addition to, packs and baths. They must be given carefully, especially if the patient has a tender skin, in order to avoid abrasions. Two common methods of giving them are:

Method 1.—Rub the patient with coarse wet salt for about ten minutes and then spray her with water which, at first, is about 80° F., but gradually reduce this temperature to 65° F. Envelop her in a warm sheet and dry her by rubbing briskly over the sheet.

Method 2.—Wring two towels out in a supersaturated solution of salt. Allow them to dry, rub the patient with these until the skin is well reddened; then proceed as for rub No. 1.

These rubs can be given in the bath-tub or in bed; in the latter case, protect the bed as for a spray bath.

CHAPTER XII

DOUCHES

The Requisites for and Methods of Giving Spinal, Vaginal, Intra-Uterine, Nasal, Throat, Ear, and Eye Douches.

A DOUCHE is a stream of water directed against a part.

PURPOSES.—Douches are applied both to the exterior of the body and to such cavities as communicate with the outer air. The purposes of douches directed against the outer surface of the body are the same as those of baths and packs and, as stated in the preceding chapter, the douche in many cases has two points of advantage over the other two forms of treatment: (1) The percussion effect, in itself, stimulates the nervous system; (2) a higher degree of heat and a lower degree of cold can be used. Douching of cavities and the eyes is done most generally (1) to cleanse, (2) to reduce congestion or inflammation, (3) to arrest hemorrhage.

Spinal Douches

The method of giving external douches depends so entirely upon the nature of apparatus and room and can be so easily and so much better explained with the apparatus at hand that no attempt will be made to

describe the methods of giving them here, other than the spinal douche, when there is no regulation appliance to be had.

Method of Giving when the Patient Can Get Out of Bed.—Place a board across the bath-tub at the opposite end from the faucets; place a folded sheet or an old blanket on the board; have the patient sit on this; replace her clothing with a sheet, drape this around her legs and chest, leaving the back exposed. If possible to arrange it, attach a spray to the faucet and play the water up and down the patient's back, or if the douche is to be localized, direct it against the part prescribed. Frequently, it is required to change the temperature of the water, alternating hot and cold. When this is the case, always test the temperature of the hot water on your *arm* before directing it against the patient, and if there is any danger of the water running very hot, the patient's feet should not be in the bath-tub but on a small stool or in a foot-tub or basin. The treatment is usually finished with massage of the back. If a spray cannot be obtained, water can be poured over the back from a pitcher.

Method of Giving Douche when the Patient cannot Get out of Bed.—Arrange the bed as for a spray bath (described in the preceding chapter); have the patient lie with her back upward, or else on her side; place a large bath towel over her legs; remove the bedclothes. If a spray, as described in Chapter XI, cannot be obtained, pour the water slowly up and down the spine from pitchers. Massage of the back is usually given after, and sometimes during, the douche. During the douche, it is often desirable to have a hot-water bag at the feet. When removing

the rubbers, the same precautions against getting the floor wet must be observed as after a spray bath.

Vaginal Douches

NATURE AND TEMPERATURE OF SOLUTIONS.—The solutions very frequently used for vaginal douching are: Normal salt solution, boric acid solution 2 per cent., carbolic acid solution 1 : 120, creolin 1 per cent., lysol ¼ per cent., green soap 1¼ per cent. The lysol is most commonly used for disinfection and cleansing, and the green soap solely for cleansing purposes. The temperature of douches used for cleansing purposes is usually between 110° and 112°, and that of those intended for the relief of inflammation, or to check hemorrhage, 118° to 120°. When preparing douches of such a high temperature, it is very important to be sure that the temperature is correct, as anything much hotter would burn the patient. Two to three quarts or more of solution are usually used for a douche.

NECESSARY APPLIANCES.—The appliances necessary for giving a vaginal douche are: (1) A warmed douche pan[1]; (2) a douche can or bag[2] to which a long piece of rubber tubing provided with a stopcock is attached; (3) a douche nozzle,[3] (4) a sheet; (5) a sterile dressing towel, and (6) if the patient has a vaginal discharge, a basin with boric acid and three to

[1] Douche pans are made from three to eight inches high. Pans of the size last named are used when a large quantity of water is required. Vessels of this size also have the advantage of raising the pelvis and thereby making the douche more effective.

[2] Agate cans or glass irrigators are preferred for hospital use.

[3] In cases of perineorrhaphy a glass catheter is often used instead of the regular douche nozzle.

six sterile sponges. The douche nozzle is prepared for use by boiling for five minutes (see page 45). The douche can and tubing are likewise sterilized for douches given after operations on or around the vagina; at other times, it is usually considered sufficient preparation to fill the can with boiling or very hot water and allow this to run through the tubing. Even when the tubing is sterilized, water should be run through it previous to use, because rubber tubing soon becomes softened and disintegrated and pieces of rubber may be washed out with the douche. The stopcock is then closed and the solution poured into the can; the nozzle attached to the tubing is put between folds of the sterile towel. To carry the douche to the patient, the can is placed in the douche pan and covered with the towel between the folds of which the douche nozzle has been placed. The rubber tubing must be arranged so that it will not be pulled upon or drag the nozzle out of place.

How to Give the Douche.—To administer the douche, get the patient into the dorsal recumbent posture. Place the douche pan in position. Dispose a soft pillow under the small of the back of the patient in such a way that its end will come over the edge of the douche pan; fold down the upper bedclothes, with the exception of the sheet and one blanket, to the foot of the bed; loosen the sheet and blanket, and twist a corner of the lower end of the sheet around each of the patient's feet and the lower part of her legs, gathering it up in the center enough to be out of the way while giving the douche, but not enough to expose her. Place the douche can about two feet above her. Wash off any vaginal discharge; let some solution run through the tubing, etc., to expel

the air. Insert the nozzle gently, pointing it downward and backward. Move it around, while it is in the cavity. Just before all the solution has escaped from the can, shut the stopcock, remove the nozzle, and dry the patient with the towel.

Points to Remember in Giving a Douche.—(1) In order that the solution may enter the vagina properly, the patient's shoulders must be lower than her pelvis, therefore she should not, if possible to avoid it, have more than one pillow under her head and shoulders while having a douche. (2) If any discharge is present, be sure and remove it before inserting the nozzle, and in doing so, hold the sponge so that your fingers will not by any chance be soiled with the discharge, and disinfect your hands after giving the douche. Vaginal discharge is very often due to purulent conditions caused by gonococci infection. (3) The douche can must never be placed more than about two feet above the patient. There are two important reasons for this: (*a*) especially after a woman has borne a child, the external os of the uterus may in diseased conditions become relaxed, and if a douche is given with much force, discharge may be driven into the uterus, and, naturally, the higher the can is, the greater will be the force of, and the quicker, the flow. (*b*) The effect of the heat is usually one of the most desired effects of the douche, and if the solution is allowed to flow too quickly, the parts will not be subjected to the treatment long enough to do much good, without the use of an unnecessary amount of solution, which will greatly complicate the giving of the douche. To get the full effects of the douche, the treatment should take twenty minutes.

Care of Douche Utensils.—After use, the utensils must be properly cleansed and well dried. Ordinarily, letting hot water run through the can and tubing is sufficient, but any stains or marks must be removed. When the can is returned to its place, the rubber tubing should be allowed to hang so that it will drain properly, for if moisture remains in it, the rubber will very quickly become softened. The pan should be washed with soap and water and rinsed in very hot water or, if the patient for whom it was used has a discharge, sterilized. The douche tip, after being washed in soap and water, should be boiled for five minutes.

The Intra-Uterine Douches.—Except in extreme emergency, a nurse should not give an intra-uterine douche, there being considerable danger involved in the treatment; *e. g.* (1) if the uterus is in a diseased condition, its walls could be very easily perforated by unskillful manipulation of the douche nozzle. (2) The slightest break in asepsis may result in a very serious infection. (3) Infectious matter may be easily washed into the tubes and cause pyosalpinx.

Instruments and Appliances Required for an Intra-Uterine Douche and their Preparation.—The only instruments generally required for the giving of the douche, unless it is to be supplemented by other treatment, will be the intra-uterine douche nozzle, the bi-valve speculum, and the uterine dressing forceps. These must be sterilized by boiling for five minutes. The other articles necessary are: about 12 sterile sponges; 1 tube of sterile gauze packing; 3 sterile towels; lysol 10 per cent. (or other sterile substance with which to lubricate the speculum); the douche pan; the sheet with which to cover the pa-

tient; long stockings; liquid green soap 50 per cent.; and a disinfectant for cleansing the vagina before the introduction of the nozzle into the uterus; a sterile apron and sterile rubber gloves for the doctor. The solution for the douche, the irrigator or can into which this is put, and also the rubber tubing attached to it must be sterilized, preferably by boiling.

Preparation of the Patient.—To prepare the patient, first have her void urine, then wash in and around the vagina with, first, green soap and water or a 1 per cent. lysol solution, and afterward with a disinfectant—the disinfectant used varies in different hospitals—and, usually, a vaginal douche is given; sometimes, however, the physician prefers to give this himself before he commences the uterine douche. The articles necessary for the preparation are not included in those mentioned for the intra-uterine douche. The patient is placed in the same position as for a vaginal douche, but, in the hospital, she is often put on the table used for such treatments, and in such case a Kelly pad and pail will be needed instead of the douche pan.

After the physician has inserted the speculum, he generally further cleanses the surface around the cervix, and then, after first letting water run through the nozzle to expel the air, he inserts its tip gently into the uterine cavity until it is felt to touch the fundus. The douche pan must not be placed more than two feet above the patient, for the fluid must not enter the uterus more rapidly than it can escape or it may be forced into the tubes and carry with it some of the foreign matter that it is intended to wash from the uterus.

Nasal Douche

Necessary Articles.—For a nasal douche, there will be needed:

(1) A small irrigator with 12 inches of rubber tubing attached, or a fountain syringe.

(2) A nasal tip.[1]

(3) A basin to catch the liquid.

(4) A towel.

(5) A gauze handkerchief.

(6) The solution—in hospitals, salt solution 1:500 at a temperature of about 108° F. is very generally used.

Method of Giving.—Pin a towel around the patient's neck; have her sit with her head slightly tilted (so that the nostril in which the nozzle is to be inserted is uppermost) and bent over a basin, which may either be held or placed on a table. Tell her to keep her mouth open and to breathe through it, not her nose, during the treatment. Expel the air from the tube by letting the solution run, and then, checking the flow, insert the nozzle in one nostril (see following paragraph) and the solution will enter through this nostril and escape through the other one and thus wash out the nasal cavity.

Danger and Precautions.—If a nasal douche is not properly given, there is considerable danger of fluid and infectious matter from the throat entering

[1] Various forms of syringes are sometimes used instead of an irrigator for washing out the nose, but as there is likely to be more, and even less, force exerted in their manipulation, many physicians do not consider them as safe for general use. When using them, the procedures and necessary caution are about the same as when the appliances mentioned above are used.

an Eustachian tube and causing an otitis media. The points to observe in order to prevent this are: (1) The solution must be hot, about 105° F., a cold solution being likely to cause irritation and consequently coughing, which would be likely to force foreign matter into the Eustachian tubes; (2) allow only small quantities of solution to enter the nostril at a time; (3) hang or hold the irrigator about two or three inches above the patient's nose, not higher, or the solution will enter with such force that it may drive infectious matter into the Eustachian tubes; (4) if one nostril is obstructed, the solution should enter by that nostril; it will wash out the more open one as it escapes, but if it is allowed to enter by the non-obstructed one, it may cause too much pressure, because it will not be able to escape as quickly as it enters; (5) instruct the patient not to swallow while the solution is flowing into the nostril; doing so depresses the tensor palati muscles and thus enlarges the opening to the tubes; (6) the patient's head is to be kept bent forward; (7) her mouth open, and she is to breathe through her mouth; (8) any excess fluid remaining after the irrigation should be allowed to flow from the nose, or else be drawn into the mouth and expectorated, but not blown from the nose with any force; (9) the douche should be stopped at any time if the patient starts to cough or choke. This will probably happen more frequently the first few times the douche is given.

Pharyngeal Douche

Purpose.—Pharyngeal or throat douches are most frequently used (1) as preparation for operation on

the interior of the throat and (2) as a cleansing agent in suppurative conditions of the throat.

Necessary Appliances.—The requisites for giving such a douche are: (1) an irrigator with (2) a piece of rubber tubing three or four feet in length attached; (3) a tip—a curved drinking tube is often used; with a small child or patient who is likely to bite the glass, the tip can be dispensed with; (4) a tongue depressor is often necessary, and is always required when the tip is not used; (5) a small roll of bandage or something to put between the teeth will be required if the patient is unconscious or delirious or a small child; (6) a dressing rubber; (7) a dressing towel; (8) a basin; (9) one quart of the required solution—normal salt solution, boric acid 2 per cent., and sodium carbonate 1 per cent. are often used. The temperature often prescribed for the solution is 100° F., but this varies.

Method of Giving Douche.—The patient can be in either a sitting or recumbent position, but her head must be bent forward in order to prevent the discharge, if such be present, being washed down her throat. Place the rubber, covered with the dressing towel, in such a way that it will protect the patient and the bed; hang the irrigator about three feet above the patient's head; put the basin in position to catch the solution, which will flow from the patient's mouth; depress the tongue—this can sometimes be done with the irrigating tip; if not a depressor must be used. It is very important that the tongue be well depressed, because when the patient's head is bent forward it is almost impossible to see if you are washing the diseased parts properly, therefore it is very essential that there be nothing to prevent the solution reaching all parts of

the throat. Move the tip from side to side, that the solution may reach all parts of the pharynx.

The Aural or Ear Douche

Necessary Appliances.—The best appliance for douching or washing out the ear is the *return aural nozzle*[1] attached by means of rubber tubing to a douche can or irrigator. The tubing which connects the nozzle and irrigator is fastened to the straight end of the nozzle, where the entrance to the inside channel is, and there must be a clamp on this tubing; another piece of tubing of equal size—about ¼ inch in diameter and 18 inches long—is fastened to the side branch of the nozzle, which is intended to form an exit for the return flow. In addition to the nozzle, irrigator, and two pieces of tubing, there will be needed the solution—normal salt solution or boric acid, at a temperature of about 100° to 105° F. if intended merely for cleansing, or about 105° to 110° F. if given for the relief of pain or inflammation, is used very frequently,—a basin, a small dressing rubber, a dressing towel, and a little sterile absorbent cotton.

To Give the Douche.—Have the patient sit or lie with the affected ear uppermost; place the rubber covered with the towel about her neck; put the end of the tubing intended to carry off the return flow into the basin; hang, or have some one hold, the irrigator about 12 inches above the ear that is to be douched. If there is any discharge around the outer part of the ear, wipe it off with a cotton sponge before

[1] The reason why the return nozzle is generally preferred to the bulb syringe is that the douche can be given without any pressure on the drum, and thus causes no pain.

inserting the nozzle. During the giving of the douche, if the patient be an adult, hold the auricle of the ear upward and backward, or, if the patient be a child, downward and backward. The reason for holding the ear in this way is that the external part of the auditory canal is cartilaginous and the internal is hollowed out of the temporal bone and is slightly arched, its central portion being the highest. This arch, it can be easily realized, will interfere with the free access of the solution to the ear drum, unless the outer cartilaginous portion is raised by making upward traction on the auricle. Until a child is two or three years old, the shape of the canal is different owing to the lack of development of the bone, and the solution will reach the drum better if the auricle is pulled downward.

If the douche is given properly, the solution will flow gently into the ear through the central channel of the nozzle and out through the side branch into the basin, and after the first few seconds the patient should experience relief rather than pain. If pain or dizziness is caused, the physician should be told.

Method of Giving Douche with a Syringe.—The main differences in this method are: (1) The basin to catch the return flow must be held directly under the lobe of the ear, and if, as is often the case, the patient holds it herself, be sure that it is held perfectly straight, for if it becomes tilted the water will be spilled. (2) The nozzle of the syringe must not be allowed to completely obstruct the canal, for the solution should be allowed to escape as quickly as it flows in, otherwise there will be too much pressure on the drum.

Douching the Ear to Remove Cerumen or Wax.—The point of difference in douching the ear for this

purpose is that the irrigator must be held at a considerable height or, if a syringe of any kind is used, it must be worked with slight force, because, in this case, pressure is needed to dislodge the wax, and, as the latter forms a pad over the drum, it cannot be easily injured, as it otherwise would, by the pressure.

Drying the Ear.—Usually, the physician wishes the ear well dried after the douche. To do this make small pointed pledgets of absorbent cotton, hold the auricle in the proper position, insert a pledget, leave it in for a few seconds to absorb the moisture, and then remove it. Repeat the procedure, using dry pledgets each time, until the cotton, when removed, is perfectly dry. Never put a pointed instrument into the ear.

Eye Douche

Requisites.—(1) A basin containing about one pint of solution—boric acid 2 per cent., temperature 100° F., is often used,—(2) some sterile absorbent cotton sponges, (3) a basin to catch the solution as it flows from the eyes—a kidney basin is preferred,—(4) a rubber, (5) a sterile dressing towel, (6) a basin for the used pledgets, (7) a probe or applicator. When cleansing the eye after an operation, or when it is inflamed, everything except the basin last named and the rubber should be sterile, including your own hands, and at all times everything used must be scrupulously clean.

Methods of Giving Douche

Method 1: Used for an Inflamed Eye.—Have the patient sit or lie, as circumstances require, with

the head so tilted that the eye to be treated is lower than the other one.[1] Adjust the rubber, covered with the towel, in such a way that it will protect the clothing, and place the basin in position to catch the solution as it runs from the eye. Wipe away any free discharge that there may be on the lids; do this very gently with a cotton sponge wet in the solution; wipe from the inner toward, but not to, the outer angle, wipe downward and outward from the outer angle. Never use the same sponge twice. Next, evert one lid (see paragraph below) and squeeze a current of solution over the eye from a sponge, directing the current from the inner to the outer angle of the eye, otherwise the discharge may be washed into the lachrymal sac and a serious inflammation result. Continue to douche the eye in this way until all discharge is washed away, wiping it as previously directed when necessary. This must be done *very gently*, and once a sponge has touched the eye, it is to be discarded. Next evert the other lid and repeat the process.

If both eyes are to be douched, separate utensils must be used for each eye, and you must thoroughly disinfect your hands before douching the second eye. If only one eye is infected and there is any quantity of discharge in that eye, the well eye should be protected with a Buller's Shield or other protector. A description of an improvised Buller's Shield will be found in Chapter XXV.

Method of Everting the Lids.—To evert the lower lid, place the thumb near the margin of the lid

[1] If the patient is a small child, it will probably be necessary to restrain and hold him as described on page 178.

and press it downward, while the patient looks upward. To evert the upper lid, catch the lashes of the upper lid between the thumb and index finger and pull the lid gently forward from the eye, and at the same time place a probe or applicator horizontally across the lid and then turn it back over the implement.

Method 2.—When the eye is not inflamed, it is not always necessary to evert the lids, and instead of doing so, draw them apart with the thumb and finger of your left hand, making what pressure is necessary on the malar and frontal bones; at the same time, have the patient look up. The solution is then poured over the eye as in Method 1.

Drops not intended for cleansing are put in near the outer angle of the eye. This will be further discussed on page 448.

Method 3.—This method can be used only for adults and older children, and is not considered good for suppurative conditions. The required articles are the solution and an eye-bath. This is a small oval-shaped cup. The bath is filled about two thirds full of solution; the patient's head is bent forward, and the cup pressed firmly over the closed eye; then holding the cup in position, the head is thrown backward and the eye alternately opened and closed for the prescribed length of time, which is usually two to five minutes. The head is then bent forward and the cup removed.

CHAPTER XIII

ENEMATA AND OTHER FORMS OF INTESTINAL INJECTIONS

Different Kinds of Enemata. Their Purposes and Natures. Methods of Giving Enemata. Nature, Purpose, and Methods of Giving Enteroclysis and Protoclysis. Care of Rectal Tubes.

Enemata

DEFINITION.—An enema (plural "enemata") is a rectal injection given either to wash out the intestine or to provide an individual with food or medicine.

VARIETIES OF ENEMATA.—Some of the more common kinds of enemata and their purposes are as follows:

1. Anthelmintic enemata, given to destroy worms.

2. Antiseptic enemata, given to destroy germs.

3. Astringent enemata, given to contract the tissue and superficial capillaries and used both in case of hemorrhage and in certain forms of diarrhea.

4. Carminative enemata, given to relieve flatulence.

5. Emollient enemata, given to soothe irritation of the mucous membrane of the intestine, thereby checking diarrhea, etc.

6. Nutritive enemata, given to afford nourishment when it cannot be taken by mouth.

7. Purgative enemata, given to increase peristalsis and wash out the intestine.

8. Sedative enemata, given as a sedative, either local or general.

9. Stimulating enemata, given for general stimulation.

10. Saline enemata, given to supply the tissues with fluid and thus relieve thirst.

Quantity of Liquid Used for Enemata.—When, to be of use, an enema must be absorbed, as is the case with a nutritive or stimulating enema, or when its object is to produce some local effect upon the mucous membrane of the intestine, only a small amount of liquid—six to eight ounces—is given, because, in the first case, if the bowel is over-distended by the injection of a large amount of liquid, the enema will not be retained; and, in the second case, if the liquid given is too much diluted its effect on the mucous membrane will be minimized. When, on the other hand, the washing out of the intestine is the main object of the injection, as with the soapsuds enema, a larger quantity of liquid is used. The amounts will be given on page 359.

Temperature of Liquid.—Enemata, with the exception of those required for stimulation and to arrest local hemorrhage, are generally given at a temperature of 100° to 105° F. When stimulation is desired, the temperature should be higher, namely, 110° to 112° F., heat, in itself, being a valuable stimulant. When an enema is given as a hemostatic, its temperature must be 118° to 120° F. The reason why this high temperature is necessary will be found on page 638.

Methods of Preparing and Giving Enemata when only a Small Amount of Liquid is Required.

Requisites.—(1) A rubber catheter; (2) glass

conneeting tube[1]; (3) a piece of rubber tubing about twelve inehes long—this is attached to the eatheter by means of a eonneeting tube; (4) a funnel[2]—this is inserted in the rubber tubing; (5) a graduated glass eontaining the liquid; (6) a piteher of hot water—the glass is stood in this so that its contents will keep warm until required; (7) a little soap[3] solution, to lubrieate the eatheter; (8) a bed-pan[4]; (9) a small rubber; (10) a towel; (11) a small blanket.

Position and Preparation of Patient.—The patient may lie either on her baek or on her left side with her knees drawn up. Plaee the blanket across her ehest and abdomen and turn down the bed eovers thus far. Place the rubber, eovered with the towel, in position to proteet the bed.

Method of Giving Enema.—(1) Lubricate the eatheter. (2) Take the funnel in your left hand, holding it between your thumb and index finger, with the tubing passing between your first and seeond finger. In order to expel the air from the tubes, fill the funnel and then allow some of the liquid to flow baek into the glass; to prevent it all doing so, raise your seeond finger and thus draw the tubing aeross the lower opening of the funnel. (3) Insert the eatheter in the

[1] It is usually advisable to attach rubber tubing to catheters, rectal tubes, etc., by means of a glass connecting tube, because, if the liquid does not flow properly, or if there is air in the tube the defects can be perceived by looking in the glass tube.

[2] A syringe is often used instead of a funnel when the substance used for the enema is thick, as oil, or starch solution.

[3] Oil or vaseline is sometimes used for this purpose, but these substances soften rubber catheters and rectal tubes and make them more difficult to clean; also they are likely to soil the sheets.

[4] The latter is only needed in case the patient cannot retain the enema. She should not be allowed to see it.

rectum, slowly, about eight inches. (4) Fill the funnel, but wait a few seconds before allowing the liquid to run, so that any irritation of the intestine due to the introduction of the catheter will subside. (5) Let the liquid flow in slowly, observing the following precautions: (*a*) do not hold the funnel more than eight inches above the patient; (*b*) if the liquid causes distress when it enters the rectum, lower the funnel to decrease the speed of the flow and press a fold of the dressing towel covering the rubber against the anus; (*c*) make pressure on the tubing the instant the last of the liquid leaves the funnel,[1] wait a full minute, and then, still making pressure on the tubing,[2] remove the catheter; (*d*) press a fold of the towel covering the rubber tightly against the anus until all desire to expel the enema has subsided.

Anthelmintic Enemata.—Enemata of quassia are frequently given in the treatment of seat worms. The infusion, about half a pint, is usually used. This is heated to about 105° F. and injected into the rectum in the manner just described, and the patient is encouraged to retain it for fifteen or twenty minutes.

Carminative Enemata.—A carminative enema is usually given either with or before a soapsuds enema. The carminatives in most common use are turpentine and asafetida.

Turpentine Enemata.—Turpentine when not exposed to the air, and thus allowed to evaporate readily, is likely to cause blisters and, therefore, when used for enemata, it is often combined with oil in the

[1] This is to prevent air entering the intestine.

[2] If air enters the tube it will force out any liquid that is in it and thus soil the bed.

proportion of about one half, or one, ounce of turpentine to six ounces of oil.

To prepare a turpentine and oil enema, heat the oil to about 110° F., add the turpentine, and either shake or stir the mixture thoroughly. This enema is given in the manner already described except that it is better to use a medium-sized rectal tube instead of a catheter, the oil being too thick to flow through the latter readily. The patient should be encouraged to retain the enema for at least half an hour and at the end of that time a soapsuds enema is given.

When the turpentine is given without the oil, it is added to about a pint of soap solution, prepared as described on page 359. As the mixture must be very well shaken, it is well to prepare it in a flask or bottle. This enema is not to be retained and it is followed at once by a soapsuds enema.

Asafetida Enemata.—It is the milk of asafetida that is usually used for enemata. The amount prescribed for an enema varies from two drams to two ounces, according to the age of the patient. The asafetida is added to about six ounces of water, about 110° F. Except when the patient is a child, it is well to use a rectal tube, instead of a catheter, for the giving of this enema, because the fluid should be injected as far into the intestine as possible. The patient should be encouraged to retain the liquid for half an hour, when a soapsuds enema is given.

Oil Enemata.—An enema of olive oil is often prescribed for a patient who is very constipated, in order to soften the fecal mass. About six ounces of the oil are used and it is heated and administered in the same way as the oil and turpentine enema. After perineorrhaphy operations, an oil enema is frequently

given every time a patient has a desire to have a movement of the bowels, in order to soften any hard feces that might cause stretching of the parts and thus pull on the stitches; in such case it is better to use a catheter instead of a rectal tube and a syringe instead of a funnel, and the oil must be sterile. After inserting the catheter in the rectum, fill the syringe with oil and then expel the air by expressing some of the oil; insert the point of the syringe in the catheter and force the oil through the catheter, not, however, using any more force than necessary to make the oil flow slowly. If the syringe is so small that it is necessary to refill it, pinch the end of the catheter before removing the syringe, and, before reinserting it, expel the air as previously described.

Emollient Enemata.—The emollient enema in most common use is starch. To make a starch enema, dissolve one teaspoonful of starch in a little cold water, add, slowly, six onces of boiling water, and boil one or two minutes, at the end of which time the mixture should be of the consistency of cream, but if it has become too thick add enough hot water to make it the right consistency. Allow the mixture to cool to 103° F. before giving it. When opium is ordered, add it just before giving the enema. The starch, like the oil, can, if necessary, be forced through the catheter with a syringe.

Nutritive Enemata.—Nutritive enemata, as previously stated, are given, when, for any reason, a patient cannot take her food by mouth. Food that is to be administered in this way must be at least partially digested before being given, because there is no digestive juice secreted in the large intestine, as there is in the stomach and small intestine, and, there-

fore, unless food passes through the stomach and small intestine it cannot be digested.

The ingredients most commonly used for nutritive enemata are: some kinds of peptonized beef-extract or juice, peptonized milk,[1] egg, salt, and dextrose. The amounts in which these ingredients are used vary. Usually, between three and six ounces of milk are prescribed; the egg is often omitted and sometimes half a one is used and sometimes only the white; dextrose is prescribed in amounts varying from one to four drams, or frequently it is omitted; the amount of beef used varies from one dram to two or three ounces, some of the beef extracts used for enemata being more concentrated than others. The amount that should be used is usually stated on the jar containing the extract.

To combine the ingredients: Heat the milk to 115° F.,[2] add this to the beef,[3] slowly, stirring the latter

[1] To Peptonize Milk for Enemata.—In a clean milk bottle, dissolve 5 grains of pancreatis—extract of pancreas—and 15 grains of bicarbonate of soda in about 3 ounces of tepid water; to this, add one pint of fresh milk and shake the bottle well; then, stand it in a pan of water 115° F. Let it remain thus for two hours, keeping the water between 100° and 115° F. The Fairchild's tubes of peptonizing powder, which are often used for peptonizing milk, contain 5 grains of pancreatis and 15 grains of bicarbonate of soda and, in private nursing, if the enemata are not to be continued for any length of time, it is cheaper to buy the tubes, but, for hospital use, it is much less expensive to buy the ingredients separately and, as a 5 and 15-grain measure is enclosed with the bottle of pancreatis, it is very easy to measure the two powders.

[2] The temperature should not be allowed to exceed 115° F. as, if it does, the peptonizing ferment will be destroyed and the digestive process will not be continued after the material is introduced into the intestine as, otherwise, it will be.

[3] When the beef extract is in solid form, it is better to dissolve it in hot water before adding the milk.

while doing so; stir the egg, but do not beat it, for doing so will incorporate too much air into the mixture; add thc salt and dextrose to the cgg and, when these are well mixed, pour in the milk slowly, stirring the egg while doing so. If the temperature of the mixture is bclow 105° F. raise it to that degree by standing the vessel containing it in hot water.

Patients who are receiving nutritive enemata should be given a purgative enema daily. Otherwise, absorption in thc largc intestine being slow and incomplete, there is danger of an accumulation of residue, which will cause sueh irritation of the mucous membrane of the intestinc that thc chanees of the retention and absorption of the nutritive enemata will be mueh lessened.

Stimulating Enemata.—Whisky or brandy and salt solution are the most common ingredicnts of stimulating enemata. The temperature, as previously stated, should be about 110° F. After giving a stimulating encma, wateh the pulse to see if the enema has produced the desired result. These are not now used as much as formerly, protoelysis and entcroclysis being generally considered morc effeetual.

Sedative Enemata.—Chloral and bromidc are the drugs most commonly used for sedative cnemata. Before administering a sedative enema, make the patient eomfortable and give all impending trcatment, so that, after the enema, she may be left undisturbed.

Purgative Enemata

Why Necessary.—During illness, due to lack of exereisc and other varying conditions, the peristaltic action of the intestine is nearly always defeetive and

consequently there will be, unless effective means are taken to prevent it, an accumulation of fecal matter in the intestine. As you will have learned in your physiology, fecal matter consists principally of the residue of food, digested and undigested, that has not been absorbed, and a large number of bacteria. These bacteria, which are always present in the large intestine, cause putrefactive changes to take place in all food products entering the large intestine and, if this material is not evacuated within the usual time, these changes go so far that certain more or less toxic substances are produced and absorbed by the blood, with the following results: The liver is overworked, because it must promote chemical changes in these substances to prevent them poisoning the body; the kidneys are overworked because they must secrete and excrete these substances; also, a general malaise and ill-being is likely to be occasioned. Thus it can be seen that it is very important to prevent any such accumulation of fecal matter. The usual preventive measures are the giving of catharsis or of enemata or other form of intestinal irrigation. The more common reasons for resort to the last measures are as follows: when an immediate action is required, when nausea or other ill effects are feared from the taking of catharsis by mouth, when a thorough cleansing of the intestine is desired, or when the action of catharsis is to be furthered by emptying the lower bowel.

Medicated Purgative Enemata.—Certain cathartic medicines, as Rochelle or magnesium sulphate salts, fel bovis, and glycerin, are often given by rectum when for any reason a patient cannot take cathartics by mouth.

To prepare salts for rectal injection, add to the salts

just sufficient hot water to thoroughly dissolve them; let the solution cool, until its temperature is about 105° or 103° F. The amount of Rochelle salts usually prescribed for rectal injection is from four to six ounces; the amount of magnesium sulphate, from two to four ounces.

Glycerin enemata usually consist of from two to six drams of glycerin and one ounce of hot water. The mixture requires to be well shaken. It is generally given in the same way as the starch enema.

The salts and glycerin act as cathartics both by stimulating peristalsis and by abstraction of water from the intestinal blood-vessels. This last action favors defecation by, at least partially, liquefying the feces.

Fel bovis, which is purified ox-bile, is sometimes added to a soapsuds enema to increase the irritating action of the latter; two drams is the amount generally prescribed.

SOAPSUDS ENEMATA.—The methods of giving soapsuds enemata are somewhat different from those already described, because with this form of purgative injection a comparatively large amount of fluid is used.

Quantity of Fluid.—Two to four pints of solution will be needed for an adult and one to one and one-half pints for a small child. Larger quantities than these should not be used unless prescribed by the physician, frequent overdistention of the intestine being harmful.

Preparation of Soapsuds.—Castile, ivory, or a pure oil soap should be used, never laundry soaps, for these frequently contain some free alkali and, also, they are not always made of as pure forms of fat as the oil soaps, and they are, therefore, likely to cause too much irritation of the mucous lining of the intestine.

In some hospitals, all the small pieces of soap that can be used for enemata are put into a soap-shaker[1] and when it is required to prepare an enema this is stirred in the water until the latter is of a whitish shade. In other hospitals all small pieces of soap are put into a bottle[1] with a little water and as much of this supersaturated solution as is required is poured into the enema water. The froth must be removed from the water, because it contains air, and, as previously stated, air should not be introduced into the intestine.

The temperature of the solution for a purgative enema is usually about 105° F. If it is this temperature in the irrigator, it will be about 100° F when it enters the intestine.

Utensils Required.—In addition to the soap solution, there will be needed for the giving of a purgative enema: An irrigator[2] or douche can to which is attached a piece of rubber tubing about three feet in length, provided with a clamp, and connected, by means of a glass connecting tube, to a rectal tube; a douche pan, toilet-paper, a cotton and a rubber sheet, a blanket.

Position of the Patient.—Except under conditions described on page 364, when the knee-chest position is used, the patient is placed on her left side with her knees drawn up, or, if she cannot be turned, on her back. As can be seen by looking at Fig. 23, the soap solution will have freer entrance into the

[1] These methods serve three purposes: (1) They prevent waste and (2) the untidy appearance that small pieces of soap on the washstand give. (3) Either method is a handy way to have the soap for this purpose.

[2] If a funnel or syringe is used instead of an irrigator, the solution is put in a pitcher.

intestine if the patient is on her left, than if on her right, side. Flexing the knees relaxes the abdominal

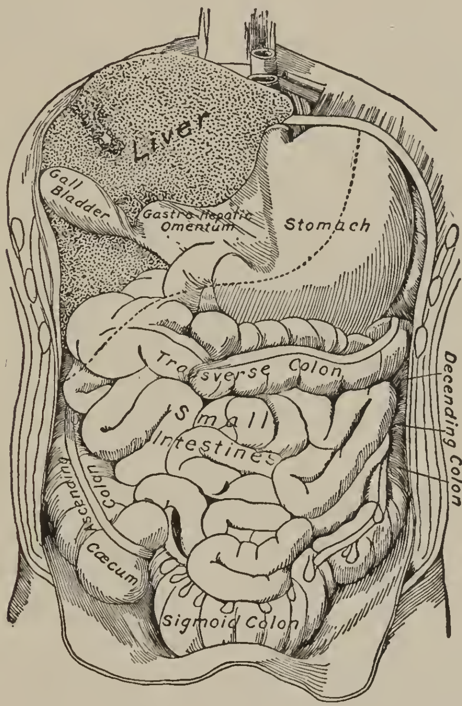

Fig. 23. The stomach and intestine. front view, the great omentum having been removed and the liver turned up and to the right. The dotted line shows the normal position of the anterior border of the liver.

muscles and thus less pressure is made on the intestine when it becomes distended with the entering liquid. If the patient must lie on her back, it is well to put the douche pan under her before giving the enema,

arranging it as described on page 338, or else to put a Kelly pad under her and raise the foot of the bed slightly. This position, also, furthers the entrance of the solution into the intestine and the thing generally desired is to get the solution as far into the intestine as possible without using force.

Method of Giving Enema.—Never keep the bedclothes over a patient while giving a purgative enema[1]; replace them with a blanket[1]; then, if the patient can be turned, draw her to one side of the bed, slip one end of the rubber[1] and cotton sheet[1]—the latter being uppermost—under her thighs, place her in position, turn the free end of the sheet and rubber up over her legs under the blanket—this will prevent the blankets and bedclothes becoming soiled if, as sometimes happens, the water is suddenly expelled or expelled with unusual force. Hang the irrigator about two feet above the patient, let some solution flow through the tubes for the reasons given on page 353, shut off the current; lubricate the tube by dipping it into the soap solution and then insert it in the rectum, gently; never use any force, for obstruction to the entrance of the tube may be due to a contraction of the intestine caused by the irritation occasioned by the entering tube; this will pass away in a minute. The obstruction, however, may be due to the presence of masses of fecal matter; this can usually be removed by letting a little of the soap solution flow into the intestine, but, occasionally, it is necessary to remove the tube and unpack the rectum with the finger.[2] When the tube has been introduced about

[1] The blanket, rubber, and sheet are not removed until the douche pan has been removed and the patient cleansed.

[2] To do this, either cover the finger with a rubber cot, or imbed

nine inches release the clamp and let the current enter, then pass the tube three or four inches farther. If the liquid does not flow, withdraw the tube slightly; if it is still obstructed, withdraw it entirely, as it is probably filled with fecal matter. This can be removed by letting the liquid flow through the tube into the douche pan. After all fecal matter is removed reinsert the tube, but start the current flowing slowly when the tube is not more than two or three inches in the rectum and insert it farther gradually. At no time should the liquid be allowed to enter the intestine quickly, and if it causes pain the current should be stopped for a few seconds—at least fifteen minutes should be allowed for the giving of an enema. If it is given too quickly so much discomfort will be caused that it will not be retained long enough to soften fecal masses (fifteen to twenty minutes) and this is essential for obtaining the best results.

Method of Giving Enema with a Funnel instead of an Irrigator.—The only difference in giving a soapsuds enema in this way is, that the liquid is poured into the funnel from a pitcher instead of being allowed to run from the irrigator. The funnel used for a purgative funnel should be larger than that used when only a small quantity of fluid is given and the tubing must be longer. The same precautions must be taken against the admission of air into the intestine as described on page 353.

Method of Giving a Purgative Enema with a Davidson's Syringe.—This, or a similar form of syringe, is sometimes used when there is a hard impac-

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the nail in soap. This is necessary not only to prevent feces from getting under the nail, but also to prevent the nail from scratching the mucous membrane of the intestine.

tion of feces above the rectum. To use a syringe of this nature, screw on the hard rubber tip, put the other end of the syringe in a pitcher of soap solution and expel the air from the syringe by pressing the bulb and so forcing the liquid through the tube. The tip is, after being lubricated, sometimes inserted in the rectum but, more frequently, the rectal tube is used as usual and the tip of the syringe inserted in this. The soap solution is forced into the intestine by pressing the bulb. Considerable force can be obtained in this way, but no more is to be used than necessary to accomplish the desired result—*i. e.*, movement of the impacted mass. To use much force is very dangerous, for rupture of the intestine might result.

Colonic Flushing.—This is the name sometimes applied to enemata given with the patient in the knee-chest position. The patient, as the name of the position implies, rests on her knees and chest, her head turned on one side, her arms at her sides, never under her. This treatment is used only in cases of intestinal obstruction, when all other forms of enemata and irrigations have failed to bring about evacuation of the bowels. The position is a very trying one and a patient suffering from such a cause is likely to be exceedingly weak; therefore, at least one nurse, other than the one giving the enema, must support her during the treatment.

Action of Soapsuds Enema.—The results obtained from a soapsuds enema are due to two causes: (1) Increased peristalsis, started by the irritation of the soap and by the dilation of the intestine by the liquid. (2) The flushing of the intestine by the solution.

Retention of Soapsuds Enema.—A soapsuds enema

is frequently retained, especially if the patient is thirsty, the fluid being absorbed to satisfy the needs of the cells. In such case, a second enema should be given.

Method of Giving Young Children Enemata.—With an infant or a young child, it is usually an irrigation, rather than an enema, that is given, for such a patient generally cannot, or will not, retain the injected liquid. Therefore, it is often necessary to do one or the other of two things: (1) Keep the child on a bed-pan during the giving of the enema. (2) Hold it on your lap, protecting yourself with a rubber sheet, one end of which you put in a pail and the other pin around the child's waist, the sides arranged so that the rubber forms a trough from the child to the pail. With a struggling child this is sometimes the better way, because if you hang up the irrigator (never more than twelve inches above the child) you have one hand and arm free to hold the child in position and to restrain its movements and the other to hold the catheter (this is used instead of a rectal tube) in place. If necessary, the child's arms can be restrained by putting a binder or wide bandage around them and the chest; this, however, should never be done if possible to avoid it. Normal salt solution is often used instead of soap solution for young children, because some physicians think the latter too irritating for a child's delicate mucous membrane. All the precautions specified for the giving of enemata to adults are doubly important in the case of children.

Enteroclysis. Intestinal Irrigation

Nature.—Intestinal irrigation differs from an enema in two fundamental respects: (1) It is desired

that a considerable portion of the liquid will be retained and absorbed. (2) Provision is made for the immediate removal of as much of it as is not retained.

Purposes.—(1) To supply the system with liquid when the body's supply is deficient for any reason, *e. g.*: (*a*) after hemorrhage; (*b*) in shock (when the blood, instead of flowing through the capillaries in the tissues to supply the latter with liquid and nutriment, remains to a great extent in the large internal vessels); (*c*) in diarrhea; (*d*) when water cannot be given in sufficient quantities by mouth. (2) To put extra fluid into the system (*a*) to give the heart more fluid to pump and thus make it strengthen its contraction and, in consequence, work more slowly; (*b*) to flush the kidneys and thus help them get rid of poisonous substances that have been taken into, or have been formed in, the body, and to prevent their being so much irritated by the poisonous substances they are endeavoring to excrete. (3) To wash out the intestine when there is any catarrhal or irritated condition of its mucous membrane. (4) To reduce flatulence. (5) To soften fecal matter and thus further the action of catharsis.

Nature and Temperature of Solutions.—Normal salt solution is the liquid most commonly used for intestinal irrigation, except when the purpose of the treatment is to correct local irritation; in the latter case, a very thin starch solution,[1] barley water,[2] or other bland liquid is sometimes used.

[1] This is made in the same way as for an enema but must be much thinner, about the consistency of milk.

[2] Barley water is made by boiling two teaspoonfuls of pearl barley in water for five minutes, throwing that water away, adding one quart of water and boiling this in a double boiler for two hours;

The temperature of the solution is of importance: if it is too cold it is likely to chill the patient; if too hot, to raise her temperature. The temperature usually prescribed is about 100° or 104° F.

Requisites.—The articles required for rectal irrigation will depend upon the method used. The first method described will require: (1) A large irrigating can or a douche bag to hold the solution; (2) stand to hold the irrigator about three feet above patient; (3) pail to catch the return flow; (4) rubber sheet; (5) bath towel; (6) soft rubber catheter, number twenty French, for the inflow. A number thirty-six French tube for the outflow. The outflow tube should have three holes in the end. It can be bought with two holes. The third can be made by cutting with scissors and rounding off the edges with a cautery or hot metal instrument, such as a knitting needle. Narrow adhesive plaster markers should be placed seven inches from the end of the outflow tube and three inches from the end of the inflow catheter; (7) two pieces of rubber tubing, one to connect the irrigator and catheter for the inflow, the second of large size to connect with the tube for the outflow; (8) a clamp to be put on tube for the inflow; (9) two glass connecting tubes, a large one for the outflow; (10) vaseline for lubrication, used perferably with a pile pipe (see page 373); (11) para acido ethyl benzoate 1, vaseline 9, may be used instead of vaseline in the pile pipe five minutes before insertion of the tubes, when the anal canal is particularly sensitive; (12) one half strength normal salt solution is used. Temperature 110°–116°, occasionally 120°.

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adding sufficient water from time to time to keep the quantity the same as at the start. It is then strained.

Technique

Method I.—The patient may lie on the back if necessary; but when possible on the side, right side rather than left; especially in right abdominal operations, the rubber covered with a towel is arranged so that the bed will be protected; the patient is brought to the side of the bed, catheter and tubes are connected, the air is expelled from inflow catheter by letting the solution flow through. The flow is then checked and the end of the inflow catheter inserted in the lowest of the holes of the outflow tube (see page 373). After both catheter and tube have been thoroughly lubricated with vaseline, they are inserted as one tube until the marker on the inflow catheter is reached. The inflow catheter is then held and the outflow tube inserted still farther until the adhesive markers are opposite. Thus the catheter is entirely removed from the tube so that they lie side by side with the markers just outside the anus. This places the eye of the inflow catheter almost on a level with the lowest hole in the outflow tube. One tube is easily inserted into the rectum, but it is difficult and often painful to insert a second. The above method obviates this fault. The end of the outflow tube should be about a foot below the level of the patient, so as not to establish too great suction and draw the rectal mucous membrane into the holes and thus cause a jerky interrupted outflow. It is not even necessary for the tube to reach the fluid in the pail. Observation of gas bubbles should be made through the glass connecting tube. There should be almost immediate return of the solution through the outflow. If it stops without intentional compression of either tube, the inflow should be shut off at once. Accumulation of fluid in

the intestine is to be carefully guarded against; such distention in a peritonitis case may be a fatal error. If patient complains of weariness and beginning exhaustion, stop irrigation at once. Should the patient complain of pain, and the outflow has been free, it may be due to the colic of excited peristalsis and precede the expulsion of gas with relief. If pain persists, stop the inflow temporarily. When the rectum contains solid fecal matter and particles are continually blocking the tube, the irrigation should be stopped. An enema or rectal lavage is better. Average amount for single irrigation 2½–3 gallons.

Remove small tube first, using gentleness with both, carefully wash dry and powder the back and anal region. An irrigation properly given will not cause pain. Often a patient will go to sleep while it is being given.

Method II—Requisites.—With the following exceptions the articles required will be the same as for Method I: (1) There must be a clamp on both pieces of rubber tubing: (2) only one rectal tube will be required; (3) instead of two straight glass connecting tubes, one T-shaped tube will be required; (4) it will be necessary to use a glass irrigator, so that the amount of fluid entering the intestine can be estimated, or else a funnel must be attached to the tubing intended for the inflow and the salt solution be poured into this from a pitcher.

Procedure.—The patient is prepared as in Method I. The base of the T connecting tube is inserted in the rectal tube, one arm is introduced into the tubing connected with the irrigator or funnel, and the other into that which is to carry the outflow into the pail. After the air has been expelled from the

tube intended for the inflow and the rectal tube in the usual manner, and the rectal tube lubricated, the latter is inserted in the rectum. Then the clamp on the tubing for the return flow is closed, and that on the tube for the inflow opened so that the solution can flow into the intestine; this it must do very slowly, and the speed, it will be remembered, is regulated by the height at which the irrigator or funnel is placed. If a funnel is used it must never be allowed to become empty or air will enter the intestine and cause discomfort. After about one half pint of solution has entered the intestine, the clamp on the tube for the return flow is opened and that on the tube for the inflow shut. After the return flow ceases, the clamp on the outflow tube is closed and that on the inflow opened and another half pint of solution allowed to flow into the intestine, and so on until the desired amount of solution has been used. When the irrigation is given to correct local irritation of the intestine, it is usually continued until the return flow is free of foreign matter.

How to Estimate the Amount of Solution Absorbed.—With many patients it is important to have some idea of the amount of solution absorbed, and this can be told easily by finding the difference in the amount of solution put into the irrigator and that in the pail which received the outflow.

The presence of any foreign matter—as mucus, blood, etc.—in the return flow should be noted and reported.

Protoclysis

Nature.—This is the name commonly given to a slow infusion of solution into the intestine. The

fluid introduced is intended to be absorbed and the apparatus used must be so arranged that all liquid that is not at once absorbed can pass back from the intestine into the utensil from which it came.

PURPOSE.—Protoclysis is very frequently used in the treatment of peritonitis, because: (1) it is thought that the large quantity of fluid which can be gotten into the system in this way reverses the lymph currents so that, instead of the absorption of septic material taking place, the lymphatic glands pour out fluid and wash out the peritoneum; (2) the extra supply of fluid stimulates the kidneys and thus helps to rid the body of toxins and septic material. Protoclysis is used also as a heart stimulant. The way in which the extra fluid injected into the system accomplishes this purpose has been already discussed (see page 366).

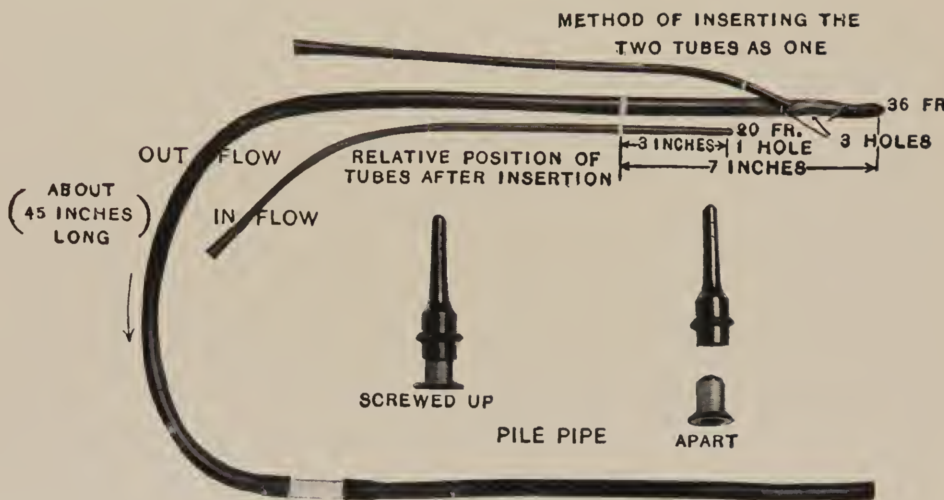
REQUISITES.—There will be needed for the treatment: (1) A douche can or other reservoir[1] provided with rubber tubing to which a medium-sized rectal tube is attached by means of a glass connecting tube. There must be a clamp on the tubing, but this must be used to control the flow of the solution only before and after the treatment. (2) The solution—this is usually normal salt solution, 105° F. (3) Some device for keeping the solution at the required temperature—in some hospitals the douche can is surrounded with hot-water bags, and the bags and can are enveloped in a heavy bath towel; in others, a thermostat is bandaged around the can, in others, an

[1] A catheter is used instead of a rectal tube in some hospitals, but many physicians consider that the diameter of the former is not large enough to allow of the free passage of gas from the intestine nor of the prompt return of all unabsorbed solution.

electric light is suspended at the top of the can. (4) A thermometer. (5) A rubber to protect the bed,—under the circumstances described on page 368 it may be better to substitute a Kelly pad,—a towel or folded sheet to cover the rubber. (6) A lubricant for the rectal tube.

Technique.—(1) Place the patient in position and protect the bed as for an enteroclysis. (2) Get the utensil holding the solution into position—how it is arranged depends upon circumstances; sometimes it can be tied to a bar at the head of the bed, at others it is placed upon a stand. It should not be higher than four or five inches above the patient's rectum to start with, but this height may have to be altered later; see next paragraph. (3) Arrange the thermometer in the solution in such a way that it can be easily read. (4) Expel the air from the tubes. (5) Lubricate the rectal tube, and (6) insert it. The length of time that the treatment is continued depends upon the physician's order; it is frequently kept up for several hours.

Precautions.—There are a few important precautions necessary in the giving of a protoclysis: (1) The rate of flow is to be very slow; the solution should just trickle into the intestine, not faster than the greater part of it can be absorbed. This is usually at about the rate of 60 to 80 drops a minute. This will mean that 1 to 1½ pints will flow into the rectum in about two hours. (2) The rate of flow must be regulated entirely by the height of the irrigator, never by the use of clamps, for any restriction of the tube will interfere with the free passage of the solution from the intestine into the tube and will cause it to flow from the rectum into the bed. An exact height for the irrigator cannot be specified; usually, it is required to



APPARATUS FOR TWO-TUBE RECTAL IRRIGATION

be between 4 and 18 inches above the patient, but the force needed will vary with different individuals and with the same individual at different times, for it will depend upon the degree of intra-abdominal pressure and the rate of the absorption of the injected fluid. Therefore, whether the height of the flask is right or not can be judged only by results; if it is right, about the amount of liquid specified on page 372 will be absorbed and there will be no leakage around the tube at the anus. It may be necessary to change the height of the irrigator several times. (3) The solution must be kept at the required temperature; this is usually about 105° F. (4) If the intestine is obstructed with fecal matter, the fact should be reported to the physician—a cleansing enema is usually ordered.

Care of Rectal Tubes.—After use a rectal tube should be cleansed by letting cold water run in and over it—before doing this, put a funnel in the tube so that the interior of the tube will be thoroughly flushed; next, wash the tube in warm water and soap-suds; and then boil it for three minutes, not longer, for boiling softens the rubber. It is said that the addition of a little salt to the water helps to prevent softening. Hang the tubes to drain before putting them away.

Catheters that have been used for enemata must be kept separate from those used for catheterization and must never be used for the latter purpose; also, they should have some mark for identification.

CHAPTER XIV

CATHETERIZATION AND BLADDER IRRIGATION

Care Necessary in Catheterization. Different Kinds of Catheters. Preparation of Utensils Used for Catheterization and Bladder Irrigation. Technique of Passing the Catheter into the Bladder: (1) with a Woman; (2) with a Man. Expedients that can be Tried to Cause Voluntary Micturition. Purpose and Technique of Bladder Irrigation. Catheterization of the Ureters.

Catheterization[1]

Definition.—By catheterization is meant the removal of fluid from a canal or cavity of the body. The catheterization most frequently referred to in connection with nursing is the removal of urine from the bladder.

Necessary Care.—Improper care in catheterization, by introducing bacteria into the bladder or by injuring the lining membrane, may give rise to an inflammatory condition of the bladder that will be very hard to cure. Therefore, the strictest asepsis must be maintained, care must be taken not to touch the end of the catheter that is to be introduced into the bladder, and great gentleness must be observed in inserting the catheter. A very important precaution that is necessary when a glass catheter is used, is to inspect the catheter carefully before inserting

[1] In connection with this chapter, the student should read pages 235 to 248.

it, for a glass catheter is very easily cracked during sterilization and, if a cracked one is used, it may break in the bladder. Glass catheters must never be used with very nervous or delirious patients or in obstetrical work. They are used only for women. Their good quality is that it can be easily seen if they are not clean; their bad, that there is danger of their breaking in the bladder.

Necessary Utensils and their Preparation.—There will be needed for catheterization: a receptacle for the catheters, 2 or 3 catheters,[1] a sterile bowl containing a hot sterile aseptic solution—boric acid 2 per cent. is very commonly used,—about 6 sterile gauze sponges, 2 sterile towels, a tray, a receptacle to receive the sponges after they have been used, another to receive the urine. If a rubber catheter is used, a small quantity of sterile oil will be needed, and for the catheterization of a male patient many doctors require a small sterile glass syringe. A sterile glove is sometimes used.

The nature of the receptacle used for the catheter varies in different hospitals. A very convenient variety consists of a narrow, shallow sterilizer, long enough to hold any kind of a catheter and provided with a perforated tray. The advantages of this receptacle are: (1) It can be carried to the bedside on the tray with the other requisites and this obviates the necessity of removing the catheter from the water in which it is boiled until it is required for use; (2) it is not likely to be used for any other purpose; (3) the catheters are not so likely to be only partly covered

[1] It is advisable always to prepare at least two catheters in case one should be rendered unfit for use by coming in contact with an unsterile surface.

by water during sterilization as they are when boiled in basins in which they cannot lie perfectly flat.

Fig. 24. Tray containing utensils for catheterization; sterilizer closed.

Catheters are prepared for use by boiling for five minutes. Rubber ones should be enveloped in gauze before being put into the sterilizer, otherwise they are likely to float on top of the water, but the gauze must not be put around them so securely that it will be difficult to undo. Silk catheters—these are used for men only—require special care as they are easily ruined; they should not be rolled in gauze and must not be allowed to touch each other, therefore, they must be boiled in just sufficient water to cover them, otherwise they are likely to float and come in contact. In some hospitals, the catheter sterilizer is provided with a perforated corrugated tray for the sterilizing of these catheters, as the ridges in the tray lessen the danger of the catheters touching each other.

The tray upon which the utensils are carried to the bedside is scrubbed with soap and water and dried; it is then covered with one half of the sterile towel, the sterile things are placed on this and covered with the other half of the towel. The unsterile things are carried separately, or, if the tray is a large one, placed in one corner of the tray apart from the sterile articles, and this part is not covered with the sterile towel.

Fig. 25. Sterilizer opened and its tray raised so that the catheter can be easily obtained.

To Prepare the Patient.— Have her lie on her back with her knees flexed and apart. Turn down the upper bed-covers, except the sheet and, if the ward or room is cold, one blanket; loosen these at the foot of the bed; fold the lower half of the blanket, if its use is necessary, back over the patient's chest; gather the sheet up in the center high enough to expose the vulva; twine a lower corner of the sheet loosely around each leg; place the sterile towel over

the pubes, having a small portion droop over the vulva so that the patient will not feel exposed while waiting.[1]

Wash and disinfect your hands as carefully as for a surgical dressing—see page 542. In some hospitals, it is required that a sterile glove be worn on the right hand; this custom is, however, not universal as the glove makes it awkward to handle the catheter. The glove is not put on until the patient has been cleansed.

Place the utensil that is to catch the urine in position with your left hand. Then proceed to cleanse the parts surrounding the meatus urinarius; to do this pass your left arm between the patient's knees, separate the labia with the thumb and first finger of the left hand, then with firm but gentle pressure wash the parts between the labia, with sponges moistened in the boric acid. Unless the sponges are large, use two at a time so that there will be several thicknesses of gauze between your fingers and the parts you are cleansing; wash from above downward. Place a dry sterile sponge just beneath the meatus, so that if the catheter slips while it is being introduced it will come in contact with a sterile, and not an unsterile, surface; a catheter that touches anything unsterile must not be used.

To pass the catheter, take it in your right hand; if it be a rubber catheter, lubricate it with the sterile oil —a glass one does not require this preparation,—and introduce it into the urethra through the meatus urinarius; this is situated in the center of the hard round elevation just above the opening of the vagina. Never use force in inserting the catheter, since any

[1] For the patient's sake, it is well if one nurse can prepare the patient while the one who is to catheterize prepares her own hands.

obstruction will probably be due to a nervous contraction of the urethra, caused by the irritation of the catheter, and it will relax in a few seconds. As soon as the bladder is reached, the urine will begin to flow; while it is doing so make gentle pressure on the lower part of the patient's abdomen. As the urine ceases to flow, partially withdraw the catheter; if no more urine passes, place one of your fingers over the opening in the free end of the catheter and remove the latter, then hold the catheter over the basin containing the urine and release your finger; then the air entering the catheter will force the urine out of it.

Care Necessary when the Bladder is much Distended.—Do not withdraw more than 16 or 20 ounces of urine when the bladder is much distended, for the sudden collapse of its walls might be injurious. Usually, the physician orders the catheterization to be repeated in three or four hours.

The special points that must be observed in catheterization after an operation on a lacerated perineum will be discussed in Chapter XX.

Passing a Catheter upon a Man.—It is a rare thing for a nurse to be obliged to pass a catheter upon a man but she should have some idea how to proceed, in case of emergency. The technique is as follows: Raise the penis to an angle of about 60° from the body. Draw back the prepuce. Cleanse the glans with boric acid solution, then wrap a small piece of gauze around the corona. The gauze covers any secretions which may remain and prevents the prepuce from slipping back over the glans. Hold the penis with the second and third finger of the left hand; separate the lips of the meatus with thumb and forefinger and cleanse them. Oil the catheter,

and introduce it slowly until an obstruction is met, which will generally occur even in the normal urethra when the catheter has passed in about six inches. Wait fully a minute, then make gentle pressure, and the catheter will readily enter the bladder. A medium size or large catheter is passed more readily than a small catheter in normal urethras.

Expedients that can be Tried to Cause Voluntary Micturition.—The use of the catheter being fraught with so much danger to the patient, catheterization should never be resorted to until various expedients, likely to cause voluntary micturition, have been tried. Some of these are: The application of hot fomentations or a hot-water bag over the bladder; pouring hot water over the vulva into the bed-pan; pouring water from one vessel into another; or, if near the bathroom, allowing the water to run from the faucet. When troubled with difficult micturition, the patient should be encouraged to drink large quantities of water, especially vichy and seltzer.

The doctor should be told if a patient goes longer than ten hours without voiding urine.

Irrigation of the Bladder

Purpose.—Irrigation of the bladder is a treatment that is frequently prescribed for the relief of cystitis. Its object is twofold: (1) To cleanse the organ of all abnormal secretions; (2) to reduce the inflammation.

Requisites.—The utensils required will be the same as for catheterization, and, in addition, two to three pints of sterile solution—either salt solution or boric acid solution, 105° to 110° F., is most commonly used,[1]

[1] Solutions of silver are sometimes used in the treatment of gonorrheal infection. These should be diluted with distilled

and, if a recurrent catheter is used, a glass irrigator; two pieces of rubber tubing about 18 inches in length, both provided with clamps—one of these is attached to the irrigator and to the projection on the catheter connected with the channel for the inflow, the other, to the projection connected with the channel for the outflow; a receptacle to receive the solution as it returns from the bladder. If an ordinary rubber catheter is used instead of the recurrent catheter, there will be required, instead of the irrigator and two pieces of tubing, a glass flask to hold the solution, and a funnel to which is attached a piece of rubber tubing, about 18 inches long, with a glass-connecting tube in its free end. With the exception of the receptacle for the return flow, all these articles must be sterile; it is not absolutely necessary that the former should be.

Procedure.—Catheterize the patient, then, without removing the catheter, arrange the receptacle that is to receive the returning liquid in position. If a recurrent catheter is used, place the irrigator not more than six or seven inches above the patient, and allow some solution to flow through the tubing, then shut off the current and attach the free end of the tube to the catheter. Attach the other piece of tubing to the projection of the catheter intended for the outflow

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water, because the chlorine of chloride salts, which are nearly always present in undistilled water, combines with the silver and changes it to chloride of mercury.

[1] The recurrent catheter consists of one tube within another. The inner one being intended to carry the inflowing current, the tubing connected with the irrigator is attached to the projection communicating with this inner tube, and the tubing for the outflow is attached to the projection communicating with the outer channel.

and put its free end into the receptacle provided for the return flow. Next open the clamp so that the solution will run into the bladder. Keep the clamp on the outflow tube shut until about $\frac{1}{2}$ pint[1] of solution has entered the bladder, then open it so that the solution will flow continuously into and out of the bladder. The reason why the return flow is checked at first is that it is wanted to distend the bladder somewhat so that all parts of its internal surface will be subjected to contact with the solution, which they will not be if the organ is in a collapsed condition.

If an ordinary rubber catheter is used for the irrigation, expel the air from the tube by filling the funnel with solution, allowing some of the latter to run through the tube and checking the flow, as described on page 352, before all the solution has left the funnel; then insert the glass-connecting tube in the catheter—this has been left in the bladder,—refill the funnel, and allow the fluid to flow into the funnel; before the latter becomes empty refill it, continue in this fashion until half a pint or a little more of the solution has entered the bladder, then, without allowing the funnel to become empty, lower it into the receptacle intended to catch the return flow and the solution will siphon back; as soon as it ceases to do so make pressure upon the tubing by encircling it and pressing with the third and fourth fingers while holding the funnel between the other fingers and the thumb, refill the funnel, and proceed as before. The bladder is alternately filled and emptied in this way until either the solution returns perfectly clear or about two quarts of the solution have been used.

[1] Not more than half this quantity would be used for a child.

Catheterizing the Ureters

The ureters are catheterized for diagnostic purposes, as in this way it can be determined whether or no both kidneys are diseased or are not functioning properly, and, if only one kidney is affected, it can be ascertained which one is at fault.

The operation is always performed by the doctor; the nurse's principal duties consist in preparing the patient and required utensils and in making sure that the urine taken from the two ureters is kept separate and not confused. In order that no mistake occur, the catheter used for each ureter is marked left and right and the glasses intended to receive the urine should be likewise marked, and the nurse must be sure that they are so marked and that she passes the doctor the proper one.

The articles usually required are: (1) Soap solution and warm water, a solution of 1 to 5000 bichloride of mercury, and sterile sponges for cleansing the external genitals. (2) All the articles required for catheterization and irrigation of the bladder. (3) A cystoscope, two silk elastic catheters, one for each ureter, two large-test tubes, or whatever receptacles are desired to receive the urine from the ureters—these and the catheters must be marked as described in the preceding paragraph; a lubricant for the catheter—sterile oil is generally used; cocaine or whatever local anesthetic the doctor requires. The three sets of utensils should be kept separate.

Strict asepsis is most important in this operation for infection of the kidney could be easily caused. The method of disinfecting the utensils, with the exception of the cystoscope, has been already dis-

cussed. The cystoscope is generally prepared for use by first washing it with green soap and water, then letting it stand in formalin 4 per cent., or carbolic 20 per cent., or alcohol 75 per cent., for half an hour, and, just before use, rinsing it in boric acid or sterile water.

Preparation of the Patient.—The patient generally wears a nightgown, wrapper, and long stockings. She is usually placed on the table in the lithotomy position, her wrapper must be folded so that it will be out of the way, and a sterile sheet draped about the lower part of her body, as described in Chapter XVIII. Sometimes the nurse is required to cleanse the external genitals, but the doctor often does this himself, before he irrigates the bladder, which he does before passing a catheter into a ureter, in order to minimize the danger of infection and to free the bladder of urine so that he will be quite positive from which ureter he obtains each specimen of urine.

CHAPTER XV

LAVAGE, ETC.

Lavage. Gavage. Nasal Feeding. Expression of the Stomach Contents by Siphonage. Tests Used to Assist in Diagnosing Gastric Disturbances.

Lavage

BY lavage is meant the washing out of the stomach.

PURPOSE.—The more common uses of lavage are, to remove poisons or irritating matter which is causing nausea from the stomach, and, in certain diseases of the stomach, to cleanse its lining membrane.

REQUISITES.—The articles required for lavage are: (1) A stomach tube lengthened, if necessary, by a piece of rubber tubing which is connected to the stomach tube by means of a glass-connecting tube; (2) a funnel, which is inserted in the free end of the tubing; (3) a basin containing ice, round which the stomach tube is rolled—the cold hardens the rubber and thus facilitates the passage of the tube; (4) a cork with a hole through the center, through which the tube can be passed, or else a small roll of bandage, to put between the patient's teeth, in order to prevent her biting the tube—these are not necessary when the patient is accustomed to the passing of the tube; (5) a rubber apron; (6) a towel; (7) two handkerchief-

size pieces of gauze, one for the patient to use as a handkerchief, the other to wipe the tube after removing it from the stomach; (8) two pitchers, one containing water 105° F. the other water 115° F.; (9) a kidney basin, to use if the patient is nauseated by the passage of the tube.

N. B.—Before starting the treatment, it is very important to reassure the patient and gain her confidence, for if she *swallows* the tube it is a very easy matter to pass it into the esophagus, and if she resists its passage the treatment is likely to prove a difficult and trying one.

The treatment may be performed with the patient either lying on her back or sitting up.

TECHNIQUE.—Put one end of the towel over the upper border of the rubber apron and tie the latter around the patient's neck. If she has false teeth on a plate, remove them. Place the pail, with the rubber under it, on the floor, in position to receive the siphonage. The stomach tube need not be lubricated, the mucus in the throat affording sufficient lubrication. Expel the air from the tube by pressing the latter, not by filling it with water, as when giving enemata, because some of the water might escape and enter the trachea. Keep the funnel mouth downward on the tray or bed. Insert the tube gently, keeping it curved while doing so, that it may follow the curve of the hard and soft palates and be directed into the esophagus without striking against the back of the pharynx, thereby causing nausea. Once the tube is in the esophagus, it should slip down easily. Do not use force; great harm might be done were the tube to be driven forcibly against the wall of the stomach. If there is any obstruction to the passage of the tube,

withdraw it, and report the abnormality to the physician. The length of the tube to insert will depend upon the size of the patient; estimate the distance from the mouth to the stomach and allow about two inches extra for the mouth. Fill the funnel with water and allow it to run slowly through the tube until only about one ounce remains in the funnel, then refill it; allow about one pint to enter the stomach in this way, and then lower the funnel into the pail and the liquid will siphon back. Repeat these procedures as often as necessary. In the case of gastritis, *necessary* generally implies until the water returns quite clear or until four or five pints have been used. Pinch the tube when removing it, otherwise water may trickle out and get into the trachea.

Points to be Remembered.—(1) Unless specially ordered lavage should not be performed within three or four hours after a meal. (2) Do not hold the funnel more than three or four inches above the patient's mouth, for the water must not be introduced into the stomach with any force. (3) Never allow the funnel to become quite empty or air will be introduced into the stomach and this would both cause pain and interfere with siphonage. (4) If pain is caused by the introduction of the water into the stomach or if there is any sign of blood in the ejected water, discontinue the treatment until the physician has been informed; for, in diseased conditions of the stomach such as ulceration and carcinoma, a dangerous hemorrhage might be caused by the lavage.

In charting the result of lavage, state whether mucus or other foreign substance was present in the siphonage and how much water it was necessary to use before the siphoned fluid was clear.

Gavage

Gavage is the introduction of fluid food or medicine into the stomach through a stomach tube. It is given when, for any reason, an individual cannot, or will not, take her food in the usual manner.

REQUISITES.—The articles required for gavage are the same as for lavage except, (1) as the fluid is not to be siphoned back, no pail nor rubbers will be required, and (2) the required food or medicine will be needed, instead of the two pitchers of water. This is usually heated to 105° F.

TECHNIQUE.—Expel the air and introduce the tube into the stomach in the same manner as for lavage. Allow a few minutes to elapse after the insertion of the tube before pouring in the liquid, because muscular contractions are sometimes started in the stomach on the introduction of the tube, which might cause the expulsion of the liquid were it put into the stomach before they had subsided. Do not hold the funnel more than two or three inches higher than the patient's mouth—the liquid should enter the stomach slowly. As soon as the last of the liquid has left the funnel, remove the tube quickly, but gently; compress it while doing so, to prevent air entering and forcing out the liquid remaining in the tube.

Nasal Gavage

A rubber catheter, which is introduced through a nostril into the esophagus, is often used for gavage instead of a stomach tube.

INSERTION OF THE CATHETER.—Keep the catheter slightly curved and pointing toward the septum while

inserting it so that it will pass into one of the nares. If there is any obstruction to its passage, remove it and try the other nostril, for the septum of the nose is rarely perfectly straight and consequently the cavity of one nostril is usually larger than the other.

Necessary Precautions.—Usually, it is easier to give gavage in this way than by mouth but there is considerable danger of getting the catheter into the trachea, instead of the esophagus; therefore, watch the patient's color while inserting the tube; if she does not become cyanosed, the catheter is probably in the esophagus. To make sure, however, put the funnel to your ear, before pouring in the liquid; if the tube is in the trachea, you will hear a whistling sound which is quite different from the gurgling sounds that are sometimes heard when the tube is in the esophagus. Another thing very likely to happen, is that the tube, instead of passing into the esophagus, may become curled up in the mouth; for this reason, before pouring the liquid into the funnel, look in the mouth; this is particularly important when, as is often the case, a patient is fed in this way after operations on the mouth.

Expression or Siphonage of the Stomach Contents

Sometimes, for diagnostic purposes, it is required to remove the contents of the stomach without diluting with water; this is accomplished by siphonage, or, as it is usually spoken of, *expression*.

The Articles Required for Expression Are.—A stomach tube, lengthened, if necessary, as for lavage; a funnel, a basin of ice round which the stomach tube is coiled, a basin to receive the substance

expressed from the stomach, a towel, two pieces of gauze about half a yard square.

TECHNIQUE.—The stomach tube is inserted as for lavage, the funnel is inverted over the bowl, which is placed below the level of the patient's stomach, and expression of the stomach contents is accomplished by pressing over the region of the stomach while the patient leans forward and strains.

Sometimes, the siphonage of the stomach's contents is started by inserting a large syringe in the free end of the stomach tube or tubing instead of a funnel and withdrawing the air from the tube by making traction on the piston of the syringe. If necessary to do this more than once, the syringe must be removed from the tube while the piston is being pushed in, and pressure made on the rubber tube before the syringe is removed; otherwise, air will re-enter the tubing.

Tests for Gastric Disturbances

PURPOSE AND NATURE.—In order to determine the nature of stomach affections, certain foods, the time required for the digestion of which is well-known, are often given and, later, the residue removed by the use of the stomach tube.

Other tests consist in the giving of certain drugs that are decomposed in the intestine and watching for the appearance of the decomposed elements in either the urine or saliva, which, depending upon the way in which the drug is eliminated from the body. The information most frequently sought by these means is (1) the rate of digestion, (2) the motor power of the stomach, (3) whether or no the stomach is secreting a normal amount of hydrochloric acid; normally, the

stomach should be quite empty seven hours after the taking of a full meal, and in a much shorter time after the taking of the restricted meals usually used for tests; and when empty the stomach should not secrete hydrochloric acid. If, therefore, after a sufficient length of time has elapsed to allow of the digestion of the food given, there is still some remaining in the stomach, some gastric disturbance, such as lack of secretion of digestive juice or deficient motor power of the stomach, is suspected and chemical analysis of the residue expressed from the stomach is made to try and determine the nature and cause of the disturbance.

Knowledge of the amount of hydrochloric acid secreted by the stomach is of great diagnostic value, for lack of secretion is characteristic of cancer of the stomach and over-abundant secretion is equally characteristic of gastric ulcer.

Some of the Gastric Tests in more common use are as follows:

1. Ewald-Boas' test-breakfast: this consists of one or two rolls weighing one to two ounces, a cup of tea without milk or sugar, and ten to fourteen ounces of water. This is given in the morning when the stomach is empty and the residue is removed from the stomach in one hour.

2. Two slices of very dry toast (no butter), and six or eight ounces of weak tea (no milk or sugar). This is given in the morning and the residue removed from the stomach by siphonage in one hour.

3. The Leube-Riegel test dinner, which consists of about fourteen ounces of meat soup, five to seven ounces of beefsteak or other meat, one and one half ounces of mashed potato, and a one-ounce roll. The

content of the stomach is removed in three or four hours.

4. Iodipin test: this test consists in the giving of a capsule containing fifteen grains (one gram) of iodipin in the morning with breakfast and afterward testing the saliva for iodine with starch paper and nitric acid every fifteen minutes. The iodipin is unaltered by the gastric juice, but is split up in the intestine, setting the iodine free. This is then absorbed and eliminated in the saliva. If the motor function of the stomach is normal so that the content of the stomach is discharged into the intestine on time, the saliva will show the presence of iodine (*i. e.*, the starch paper will turn blue) within an hour.

5. Ewald's test: this consists in having the patient urinate or, in some cases, emptying the bladder by catheterization, and then giving her fifteen grains (one gram) of salol. The patient is then instructed to urinate every half-hour and the urine is tested with neutral ferric chloride solution for the presence of salicylic acid; the salol being split up in the intestine into salicylic and carbolic acids. The presence of salicylic acid is indicated when the test gives a violet color. If the motor power of the stomach is normal, the salicylic acid should be present in the urine in from thirty to seventy-five minutes.

CHAPTER XVI

COUNTERIRRITANTS AND OTHER LOCAL APPLICATIONS USED FOR THE RELIEF OF CONGESTION, INFLAMMATION, AND PAIN[1]

Nature, Purpose, and Action of Counterirritants. Different Kinds of Counterirritants. Where and how they are Applied. Agents Used as Rubefacients. Methods of Using Heat, Mustard, etc. The Making and Application of Poultices and Pastes. Methods of Applying Fomentations to the Abdomen, Breasts, and Eyes. Technique of Cupping and Using the Cautery. Purposes of Inducing Hyperemia in a Part. Methods of Using Cantharides, Liniments, and Ointments. Action of Cold. Methods of Using Cold. The Application of Leeches.

Counterirritants

NATURE.—By a counterirritant is meant a substance that when applied to any area of the body surface will produce irritation of the sensory nerve-endings lying beneath the surface to which it is applied, and, due to nervous reflex action, thereby relieve morbid processes, such as congestion or inflammation in either adjacent or distant parts of the body.

USES.— The purposes for which counterirritants

[1] If the students have not already studied reflex action in their anatomy and physiology, they should read the sections devoted to the subject before studying this lesson, as some knowledge of reflex action will help them to understand the action of counterirritants.

are most frequently used are: (1) The relief of congestion and inflammation; (2) to cause absorption of inflammatory deposits after inflammation has subsided; (3) the relief of pain.

How Counterirritants Effect their Purpose. —Irritation of the sensory nerve-endings in any part of the body will give rise to impulses that will travel to certain reflex nerve-centers in the spinal cord or medulla oblongata in consequence of which the centers controlling the vasomotor nerves will be so affected that the blood-vessels at and around the area of application will become dilated and a larger amount of blood will consequently accumulate in this part and thus relieve the congestion in the affected area and the pain due to pressure on the nerves by the inflammatory exudation. This changing of the blood-flow also improves the circulation in the part and, consequently, favors absorption.

Where Counterirritants Are Applied.—Counterirritants may be applied (1) directly over the seat of inflammation (*e. g.*, the application of poultices over the chest for relief of congestion in the lungs); (2) at a part distant from the painful area but intimately connected with it by nerve fibers (*e. g.*, in diseases of the eye, a blister is sometimes applied to the back of the ear; for relief of pain in the knee or ankle due to hip disease, the blister is applied not to the part where the pain is felt, but to the seat of the trouble, the hip); (3) at a part quite distant and with no special nerve connection (*e. g.* a hot foot-bath for relief of congestion of the throat, lungs, headache, abdominal pain, etc.).

Different Kinds of Counterirritants.—Counterirritants may be either general or local. Examples of the first class are the baths described in

Chapter XI. Local counterirritants are subdivided, according to their nature and the purposes for which they are used, into (1) rubefacients or reddeners; (2) epispastics, vesicants, or blisterers; and (3) caustics or escharotics.

Rubefacients

Agents Used as Rubefacients.—The rubefacients in general use are: heat, both dry and moist, mustard, turpentine, iodine, certain liniments, cupping.

Necessary Care in the Use of Rubefacients.—Unless used with care, the agents employed as rubefacients will cause blisters, which, unlike those resulting from substances used for the purpose of raising blisters, are generally very hard to heal.

Heat

Methods of Using.—The agents most generally used for obtaining counterirritation by means of heat are: Hot-water bags, electric pads, hot-air baths, poultices, and fomentations or stupes.

Action of Heat.—In addition to its counterirritant action, heat expands the tissues and thus favors a greater degree of hyperemia than the other counterirritants. It also, especially moist heat, induces softening of the tissues and will, at the temperature obtained by the use of poultices, if applied directly upon an inflamed area, favor suppuration; for this reason, the use of poultices will in some instances produce very harmful results.

Hot-Water Bags.—When used to obtain counterirritation a hot-water bag must be very light, therefore it must not be filled more than one quarter of its

capacity, and must not contain air. To fill the bag, take out the cork and hold the bag mouth downward; roll it up beginning at its base—this expels the air—allow the bag to unroll as the water enters. The water should not be more than 150° to 160° F. Before inserting the stopper, squeeze the bag above the water, to expel the air, and after screwing in the stopper, hold the bag upside down to be sure that there is no leakage. Put the bag, stopper foremost, into a flannel bag, and tie the latter securely.

N. B.—Never take a patient's word as to whether a bag is too hot, judge for yourself by looking at the skin; if it is more than slightly red, the heat is too great. If a patient is in great pain, a burning sensation is often a relief, and sometimes patients will not only declare that the heat is not too great, but, unless watched, they will remove the cover from the bag.

Electric Pads.—Two important precautions are necessary in the use of electric pads: (1) Always make sure that the insulating material around the wires is intact, otherwise the bedclothes may be set on fire; (2) it must be remembered that when the pad is used continuously for any length of time its temperature will increase.

Local Hot-Air Baths.—The use of hot air in the treatment of inflammatory conditions was discussed in Chapter XI.

Poultices

What they can be Made of.—Any soft bland substance that can be mixed into a paste with water and that will retain heat well can be used for a poultice, but flaxseed or, as it is also called, *linseed* is

generally considered the best material to use for the purpose, because as it contains considerable oil, it can be used at a higher temperature than other substances without danger of blistering the skin.

MATERIAL USED TO CONTAIN POULTICE.—Large poultices are best spread on muslin and covered with gauze or cheesecloth. The material for a poultice for the chest should be shaped to fit around the neck and armpits. The muslin for such a poultice should be cut about two inches larger all around than it is desired that the completed poultice should be—this allows a margin to turn over the flaxseed; the gauze, as it is easily stretched and pulled out of place, should be about two inches larger all around than the muslin. Small poultices can be spread on gauze or any other soft thin material; the poultice substance should be spread in the center and the edges of the material folded over it. A poultice should be always covered with some material that will prevent the escape of heat, *e. g.*, old flannel or oil muslin, and it should be retained in place by a bandage or binder.

TO MAKE A FLAXSEED POULTICE FOR THE CHEST.—In the center of a towel place the flannel protector; cover this with the muslin. Have, for an average-sized woman, about one and one half pints of water boiling forcibly; into this sprinkle slowly, stirring the water with a spatula or knife while doing so, sufficient flaxseed to make a mixture just thick enough to drop from the spatula—it must be thin enough to be easily spread with the spatula, but not so thin that it will spread by itself. The mixture must not be allowed to stop boiling during the addition of the flaxseed. When the poultice is of the right consistency, add one teaspoonful of bicarbonate of soda and beat the

poultice thoroughly, so as to mix the gas generated from the sodium bicarbonate evenly through the batter; this makes the poultice much lighter. Turn the poultice on to the center of the muslin—do not begin to spread it until the utensil used for cooking has been thoroughly emptied; then fill this with water, and, afterward, spread the flaxseed, evenly, about one third of an inch thick, over the muslin except for one and one half inch margin; turn this up over the flaxseed. Cover the flaxseed with the gauze, turning the edges of the latter in between the muslin and the flannel protector. Fold the poultice, including the protector, upon itself and wrap the towel around it. Place the poultice where it will keep hot; wash the utensils used[1]; carry the poultice to the patient.

To Apply a Poultice.—Slip the binder under the patient, beneath the part that is to be poulticed. Cover the part with the towel that is around the poultice, and then arrange the bedclothes and nightgown so that they will not be in the way. Rub a little oil or vaseline over the part—this lessens the danger of blistering. Test the temperature of the poultice with the back of your hand, slip the poultice under the towel, put it on slowly, *i. e.*, do not unfold it all at once, and keep raising it from the skin until the patient becomes accustomed to the heat. Remove the towel[2] and fasten the binder. Do not make it tight enough to restrict the respiration.

A poultice should not be left on longer than one hour, as after that it is not even as warm as the body.

[1] Unless this is done the cooking utensils will be very hard to clean.

[2] This towel can be folded neatly and kept to carry away the poultice in after it is removed.

After removing the poultice, dry the surface of the skin, and if it is very red, apply a little oil or vaseline. If another poultice is not to be applied immediately, cover the part with a piece of soft flannel or with a pad, the same size and shape as the poultice, made of cotton batting quilted between two layers of gauze.

Digitalis Poultice.—To make a digitalis poultice, soak digitalis leaves in warm water until the leaves are soft, using two ounces of leaves for each pint of water; raise the water to boiling point and allow it to boil for fifteen or twenty minutes. Next, drain off the water and make a linseed poultice, using this water. Add the leaves just before spreading the poultice on the muslin. Digitalis poultices are sometimes applied to the lumbar region, when the kidneys are not functioning properly, in order to stimulate the secretion of urine.

Mustard Poultice.—Mustard is often added to a flaxseed poultice in order to increase slightly the counterirritant property of the poultice (see following paragraph). The proportion of mustard to flaxseed frequently used is, for an adult, one to eight, and for a child, about one to sixteen. Thus, as sixteen tablespoons are equivalent to one cup, two tablespoonfuls of mustard are used for each cup of flaxseed for an adult; and one tablespoonful of mustard for each cup of flaxseed for a child. Dissolve the mustard in tepid water and add it to the poultice after the latter has been removed from the fire; then, beat the poultice well so that it and the mustard will be thoroughly mixed.

Mustard

Mustard, as a counterirritant, is usually employed in baths, poultices, pastes, or sinapisms. Mustard

owes its counterirritant property to a substance which, upon the addition of heat, is changed into a volatile oil, and this oil, being volatile, is quickly dissipated; for this reason, when used in poultices and hot baths, the strength of the mustard is very much minimized, and if the mustard is to have any effect at all, the directions given regarding its use on pages 317 and 399 must be carefully followed. When the counterirritation is to depend solely upon the mustard, the water used with it must not exceed 100° F.

Mustard Sinapisms.—There are two varieties of mustard sinapisms, (1) the mustard leaf, and (2) the paste.

Mustard Leaves. These consist of a mustard preparation combined with some resinous substance which holds it to a muslin or paper foundation. They are bought in this condition and only require to be dipped in tepid water to be ready to use. To apply a leaf, rub a little oil or vaseline over the part to which the leaf is to be applied (this minimizes the danger of blistering the skin), put on the moistened leaf, mustard side next the skin, cover it with a folded towel. Leave the sinapism on until the skin is well reddened, which it generally will be in from ten to twenty minutes. After the first five minutes, however, the skin under the leaf should be looked at every few minutes, because some people's skin blisters much more readily than that of others. After removing the sinapism, wash the skin with soap and warm water, for if any particles of mustard are left on the skin, blisters will result. If the skin is very red apply a little vaseline.

A Mustard Paste.—A mustard paste is usually made with flour, mustard, and water. The proportion in which the two first-named ingredients are used

depends upon the climate. Ordinarily, in a temperate climate, about one part of mustard to three or four of flour is used, but in hot countries, or if the mustard has stood for any length of time in a warm place, it is generally necessary to use a larger proportion of mustard. It will take about five full tablespoons of material to make a paste six inches square. To make a paste, mix the flour and mustard thoroughly, crushing all lumps; add just enough tepid water to make the paste sufficiently soft to allow of its being spread. Spread it evenly, and not more than one eighth of an inch thick, in the center of a piece of gauze, and fold the edges of the gauze over the back of the paste; lay the paste on a folded towel, the side with the single layer of gauze uppermost; this is the side that goes next the skin. Apply the paste, watch, remove it, and use the same precautions as for a leaf.

Stupes or Fomentations

Abdominal Stupes.—Stupes or fomentations are very frequently applied to the abdomen to relieve abdominal pain and to reduce tympanites by increasing the peristaltic action of the intestines. When the stupes are used for the latter purpose, a rectal tube is often inserted in the rectum before beginning the treatment and allowed to remain there until it is finished. The free end of the tube should be placed in a kidney basin or other receptacle, because fecal matter is frequently expelled with the gas.

Two methods of applying stupes very generally employed are as follows:

Method I.—Articles required: a blanket, a gas stove or else an alcohol lamp, and a stand to support

a basin, a stand or block of asbestos to put under the stove, a basin of boiling water; an oil, muslin, or flannel protector; two pieces of soft flannel twice the size of the area of application, a stupe wringer or heavy crash towel, a pad of cotton batting quilted between two pieces of gauze large enough to cover the abdomen.

In some hospitals, a rubber is put under the patient to protect the bed, but in the author's opinion this is not advisable; if the flannel is left wet enough to wet the bed there will be great risk of burning the patient, and the absence of the rubber serves as a reminder to wring the flannel *very dry*.

Method of Applying Stupes.—Attach and light the stove and place the basin of water upon it. Double one piece of flannel and place it in the center of the stupe wringer, place as much of this as is enveloping the flannel in the boiling water, but leave out a sufficient length at either end to hold while wringing. Turn down the bed covers to below the abdomen, at the same time covering the patient's chest and abdomen with a folded blanket in the manner described on page 191. Turn the nightgown up above the abdomen. Pass the protector under the blanket and place it over the abdomen. Wring the water out of the flannel by twisting the two dry ends of the wringer or towel in opposite directions; do this until it is impossible to squeeze any more water from the flannel. Remove the flannel from the wringer, shake it, pass it under the protector, and spread it, doubled, over the abdomen; put it down slowly in the same way as the poultice. Place the second piece of flannel in the wringer and put this in the boiling water as before. Three minutes after the first stupe was applied, wring the water from

the second piece of flannel and put this on in place of the first piece, and place the latter in the wringer and in the boiling water.

The stupes can be changed under the protector without removing either it or the blanket or exposing the patient in the least. Continue the treatment the length of time prescribed, which is usually ten or fifteen minutes. Then wipe the abdomen and put on the cotton pad.

Method II.—The same articles are required as for Method I with the following exceptions: no blanket nor stove is needed, the boiling water must be in a pitcher and the basin empty, and a binder and safety-pins will be needed.

To apply the stupe, pass the binder under the patient's buttocks, turn her nightgown up above her abdomen, cover her abdomen with the protector and this with the cotton pad. Fold the flannel and put it in the stupe wringer; place this, except the two ends, in the basin and pour the boiling water over it; then wring and apply the stupe as in Method I, and pin the binder around the abdomen. The stupe is usually left on about ten or fifteen minutes and is then replaced by a hot one. The treatment is generally continued for the space of an hour.

Turpentine Stupes.—When turpentine is applied to the skin and covered, it does not evaporate readily and, unless it is mixed with oil, there is always more or less danger of its blistering the skin. About the safest way to use turpentine for stupes is to mix it with oil in the proportion of one part of turpentine to two of oil, for adults, and one to six or one to ten for children; and, with a cotton swab, to rub this mixture over the abdomen before applying the hot flannel as just

described. When using Method I, it is not always advisable to make an application of turpentine every time the flannel is changed—in fact, sometimes only two or three applications can be made. The oil and turpentine must be well stirred before each application, because they separate very quickly. The piston of a glass syringe is a good thing to use for doing this, and the cotton swab can be covered and tied to one end of the piston with a gauze sponge.

Fomentations for the Breasts.—These are usually applied in the same way as either Method I or Method II abdominal fomentations, but a hole must be cut in the center of the flannel for the nipple, since this should not be covered with the hot flannel.

Fomentations for the Eye.—Compresses of absorbent cotton about two inches square and one inch thick are generally preferred to flannel for this purpose. As the water used for these fomentations is not usually required to be above 115° to 118° F. the water can be squeezed from the cotton with the fingers. The compresses are changed every two minutes for the length of time prescribed by the physician, which is generally between fifteen and thirty minutes, though in some cases very much longer. As the compresses are changed so frequently, it is not necessary to use a protector to retain the heat. The water can be kept at the desired temperature either by keeping the basin containing it on a tripod or other stand over a small alcohol lamp, or by having a covered pitcher of hot water at hand and adding some of this to that in the basin from time to time. It will be, of course, necessary to keep a thermometer in the basin of water. If both eyes are to be treated, separate compresses must be used for each eye, and if there is any dis-

charge from an eye the same compress must never be used twice, and the eyes should not be treated at the same time, except with the physician's permission.

Ammonia

Ammonia is occasionally employed both as a rubefacient and as a vesicant. To use it, saturate a small piece of linen, gauze, or absorbent cotton with ammonia, apply this to the part, cover it with a protector of oiled muslin or paper, to prevent evaporation, and bandage it in place. If the ammonia is used as a rubefacient, remove it in five minutes; it usually forms a blister in about ten minutes.

Chloroform

Chloroform is sometimes used in the same manner as ammonia.

Guaiacol and Glycerin

Guaiacol mixed with glycerin is often used as a counterirritant. The mixture is applied with a cotton swab. The application must be very thin for guaiacol blisters readily. If too much is applied, wash the part with alcohol or glycerin. After the application is made, the part is covered with gauze or absorbent cotton and bandaged.

Iodine

Tincture of iodine is often painted over a part to produce a slight continuous irritation. It can be applied with either a cotton swab or a camel's-hair brush; the former is preferable because it will be thrown away after use. If necessary to make more

than one application, let one dry before making another; enough should be applied to render the painted area a deep, but not too dark, brown; if the patient complains of a burning sensation probably too much iodine has been applied, for only a slight degree of irritation is wanted. If too much is applied, wash the surface with alcohol or ammonia, since, as iodine is soluble in these substances, they will remove it.

It is important to remember that the alcohol in which iodine is dissolved evaporates readily and the tincture thus becomes stronger if it is kept for any length of time.

N. B.—When using guaiacol and glycerin or iodine, never dip the swab or brush into the bottle, but pour a *small* amount of the liquid into a small glass or other receptacle.

Cupping

There are two kinds of cupping; they are known as dry and wet. The latter is so called because incisions are made in the skin before the cups are applied, and, consequently, blood or blood and pus are extracted through the wounds. The purposes for which cupping is most frequently used are: (1) to relieve congestion in the kidneys—when used for this purpose, the cups are applied over the lumbar region; (2) to relieve congestion in the lungs—for this purpose, the cups are placed over either the anterior or posterior chest or both; (3) to cause hyperemia in an inflamed part, see page 410; and (4) in the case of wet cupping, to remove blood or pus from an inflamed part.

Articles Required for Dry Cupping: (1) A set of cupping glasses—in the hospital, glasses with

rimmed edges, specially fabricated for cupping, are usually provided, but almost any small thick glasses will answer the purpose; thin glasses should be used only in emergency and then with great care, for they might break and cut the patient; (2) a small bottle of alcohol; (3) a glass to hold the alcohol during the cupping—this must be entirely different from the cupping glasses, as otherwise the ignited rod might be put into the alcohol by mistake; (4) an alcohol lamp; (5) a box of matches; (6) a metal rod with a piece of absorbent cotton wound around one end—a piece of small brass sash-curtain rod makes an excellent rod for this purpose; (7) cotton for extra swabs; (8) a glass containing water in which to dip the burning swab when it is necessary to extinguish the flame; (9) a receptacle in which to throw the charred cotton; (10) a piece of gauze to wipe the glasses; (11) two towels—one to cover the part of the table where the glasses will be put during the cupping, so as to prevent a noise, and the other, if the patient be a woman, to put around her hair; (12) a tray to hold all these articles; (13) a small blanket or nightingale. In many hospitals the necessary utensils, except the nightingale, are kept on the tray when not in use and, when this is the case, after use, clean towels and gauze should be put on the tray and it must be seen that the bottle and lamp both contain sufficient alcohol, and the match-box, matches. When preparing to cup, cover the part of the table next which you will stand with the towel, which should be doubled; place the cupping glasses on this; leave the other things, especially the alcohol and lamp, on the tray; place the alcohol in the corner farthest from you and the patient, and the lamp at a distance from it; the reason

for this arrangement is that you will not then pass the lighted swab over the glass of alcohol. Place the blanket where you can get it quickly; it is seldom, if ever, needed, but it is wise to have one at hand in case of fire. If the patient be a woman it is well to pin a towel around her hair. If there are hairs on the patient's chest, it should be shaved, since hair takes fire very readily.

TECHNIQUE.—To apply the cups: Dip the swab in the alcohol, ignite it in the flame, hold the flame in a glass for a few seconds, and then quickly place the latter on part of the area to be cupped. Repeat the procedure until the prescribed area is covered with glasses. Heating the air in the glass causes the former to expand so that much of it leaves the glass, consequently, when the heat is withdrawn there is a partial vacuum in the glass which, when the glass is placed on the body, the flesh is drawn in to fill. Watch the color of the skin; where it becomes a deep red the glass must be removed—if a glass is left on too long, so much blood is drawn to the part that the same kind of a condition occurs as when the tissue is bruised, viz., capillaries are ruptured and there is an ecchymosis of blood into the tissue. After the entire area to be cupped has been covered with glasses, remove the cups, and, in doing this, always insert a finger under the rim, otherwise, pain will be caused wherever much tissue has been drawn into the glass. Wipe the glasses and apply them as before. The treatment is usually continued for from fifteen to twenty minutes. After the glasses have been removed for the last time, rub a little oil or vaseline over the surface, and some physicians like to have a cotton pad, such as is used after a poultice, put on.

N. B.—The following are some important points to remember in connection with cupping: (1) If the patient is conscious, tell her what you are going to do, before you begin; otherwise she may be very much alarmed. (2) Do not have so much alcohol on your swab that it will drip, or it may do so while it is burning. (3) Do not have your swab so large that the flame touches the rim of the glasses or they will become hot enough to burn the patient. (4) Do not use a swab after it becomes charred, for burning pieces may drop from it. (5) Do not apply a glass where a deep mark has been left by the action of a former one. (6) Do not leave a glass on long enough to cause ecchymosis.

Cupping with Bier's Cups.—Cupping is now often done with what are known as Bier's cups.[1] These consist of variously shaped glass cups or cylinders provided with rubber bulbs or with a point to which an exhaust pump can be connected by means of rubber tubing. The air is exhausted in these cups by squeezing the bulb or working the exhaust pump and the use of fire is thus unnecessary.

Fig. 26. Bier's Cup.

These cups are used not only to relieve congestion, but also to cause hyperemia of an inflamed part with the expectation of killing bacteria, relieving pain, and limiting the amount

[1] Called after Dr. Bier, who was the first physician to show definitely why and how hyperemia could be used in the treatment of inflammation.

of tissue destruction usual when suppuration occurs. These results are effected because the extra supply of blood brought to the part (1) provides a larger number of phagocytes to destroy the bacteria; (2) it dilutes the inflammatory exudate and toxins produced by the bacteria, and the pain, common in inflammatory conditions, is largely due to irritation of the sensory nerves by the toxins produced by the bacteria and the large amount of solid substances in the inflammatory exudate; (3) it supplies extra nourishment for the tissues, which consequently will assume a healthier condition and be less likely to break down.

Method of Applying Cup.—Choose a cup of sufficiently large diameter to completely cover, and extend an inch or so beyond, the inflamed area, oil the edges with vaseline.[1] Place the cup over the affected area and at the same time squeeze the rubber bulb. As the bulb resumes its shape, the air in the cup is partially exhausted and the tissue under the cup is drawn in to fill the vacuum, and engorgement of the capillaries in this tissue ensues.

If a cup with a suction pump is used, the edge of the cup is oiled, the cup placed in position, and the air exhausted slowly by means of the suction pump. When a pump is used, it is very easy to create a too complete vacuum and this must be guarded against. If pain and a mottled appearance of the skin are caused, the suction is probably too great. Pain will be caused also by creating the vacuum too quickly.

In the treatment of inflammation of a hand or foot, cylinders into which the part will fit are often used;

[1] This is to make the cup adhere more firmly to the skin and thus prevent the entrance of air.

these are provided with a rubber cuff which is bandaged on above the inflamed area. The skin which will come under the cuff is coated with soap or vaseline[1] before the limb is put into the cylinder as it will then adhere better. The air is exhausted by the use of an exhaust pump.

Wet Cupping.—As previously stated, in wet cupping the doctor makes a few incisions in the flesh before the cups are applied; therefore, the patient's skin must be prepared by being washed and disinfected and the cups must be sterilized before use. The same articles will be required as for dry cupping and, in addition, there will be needed a sterile scarificator or scalpel, a hypodermic filled with cocaine, sterile sponges and sterile salt solution to cleanse the skin after the cupping, sterile gauze for a dressing, adhesive plaster, a binder or bandage, a rubber to protect the bed, and two sterile dressing towels.

The cupping is done in the same manner as dry cupping except that (1) a few superficial incisions (three or four) are made before the cups are applied; (2) the cups are put on but once, being left in place until the amount of blood desired is withdrawn. After the cups are removed, the skin is washed with sterile water or salt solution and a sterile dressing applied. Wet cupping is, of course, done by the physician.

The Application of Cups over Wounds.—Cups are often placed over badly infected wounds in order to cause hyperemia and to extract pus. The Bier's cups are preferred for this purpose because larger glasses can be used and the degree of suction can be

[1] The soap is to be preferred, for if a good oil soap, as Castile or ivory, is used, it will injure the rubber less than the oil.

more easily controlled. When used for this purpose, the cups and the soap or vaseline must be sterile.

The Actual Cautery

Cauterizing is the application of heated metal to some part of the body. Pacquelin's thermo-cautery is the instrument generally used in the hospital for this purpose. This consists of a hollow platinum tip that screws into a metal tube on the end of which is fitted a piece of rubber tubing which is provided with two bulbs, one of soft rubber covered with netting to prevent its too free expansion, and another of hard rubber. When the cautery is about to be used, a small sponge which is in the metal tube is soaked with benzin. The platinum tip is then held in a flame until the tip becomes red, and it is kept hot as long as required by squeezing the bulb at short intervals and thus forcing the vapor through the cautery. Care must be taken not to fill the air reservoir—the bulb covered with netting—too full or it may burst. Another necessary precaution is, not to let the platinum tip come in contact with anything while it is hot, for not only will it burn whatever it touches, but it will itself become dented and spoiled. If, after use, there are any particles of tissue, dried blood, etc., adhering to the tip, they must be burned off by bringing it to a glow. Never cool the tip by putting it in water.

The cautery is used as an escharotic, notably for removal of tissue in certain abdominal operations, and to counteract the effect of bites of mad animals, poisonous snakes, and the like. It is used also for the relief of pain in torticollis, lumbago, and other forms

of muscular rheumatism. When used for the latter purpose, the cautery is not, as a rule, allowed to actually touch the body, but is passed to and fro near the surface of the skin until it becomes well reddened.

A flatiron is sometimes used instead of the cautery for the relief of pain in lumbago, etc. To use this, wipe the skin, cover it with one or more thicknesses of flannel, and pass the iron back and forth over the part. Look at the skin from time to time, so that it will not become too red.

Liniments

Substances that will cause irritation of the superficial sensory nerve-endings are sometimes used in the form of liniments; these are usually applied by being rubbed over the part with the hand, and the rubbing is often as beneficial as the liniment and should therefore be continued for five or ten minutes.

Vesicants

Vesicants are used when a prolonged irritation is required, especially for the purpose of causing the absorption or removal of inflammatory deposits after true inflammation has ceased.

CANTHARIDES.—Cantharides, which consists of the powdered bodies of certain beetles of Southern Europe, popularly known as Spanish flies, is the vesicant most frequently used, the blister which it causes being easily healed. It is obtained in the form of a plaster or of a solution in collodion.

A definite order regarding the size of the area to be covered should be obtained from the doctor. The usual order is one or two inches square and very

seldom, if ever, exceeds three inches, as, otherwise, not only will the resulting abrasion be unnecessarily large, but too much cantharides may be absorbed into the system, and, as cantharides has an irritating effect upon the kidneys, an acute nephritis or strangury may ensue. Since cantharides is likely to have this effect upon the kidneys, special attention should be paid to the character of the urine and the quantity of urine voided for at least the twenty-four hours following the use of the drug.

Methods of Applying Cantharides.—Prepare the skin by washing it with soap and water, shaving it, if necessary, and disinfecting it in the same manner as when an incision is to be made.

To apply a plaster, oil its surface, lay it on the skin, and put a bandage or binder loosely around the part to retain the plaster in place,[1] or else make a cap of stiff paper or oiled muslin. A cap is made by cutting a triangular piece out of each side of a square of stiff muslin or oiled muslin; bring the edges of each cut together with a strip of adhesive plaster put on as shown in Fig. 28; leave three of these strips about two inches longer than the paper—these attach the cap to the body; one side is not so attached, and this can be slightly raised to look under, to see if the blister is formed. Tape can be used instead of adhesive plaster; it will, of course, have to be sewn on. If tape is used, only two pieces need be left longer than the cap and these can be tied around the part on which the plaster is applied. Cut as much of the corners off the cap as

[1] Never fasten a plaster on with adhesive plaster nor put the bandage on tightly or there will not be sufficient space for the blister to rise.

necessary to make it fit the part to which it is to be applied.

The length of time required for the blister to rise varies with different individuals; it will usually do so in from four to eight hours. If the blister has not formed by the end of eight hours the fact should be reported to the doctor, because a plaster is seldom

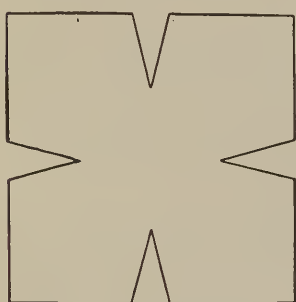


Fig. 27. Oiled Muslin Cut for Cap.

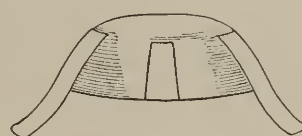


Fig. 28. Cap Formed by Bringing Cut Edges Together with Adhesive Plaster and Cutting off the Corners of the Muslin.

allowed to remain on longer than that time. If it is important to have the blister form, the physician often orders a hot poultice to be applied after the removal of the plaster, as the moisture and heat, by softening the skin, will usually bring about the desired result.

Remove the plaster gently, taking care not to break the skin; remove any adherent particles of cantharides by washing the part gently with oil. It is not usual nowadays to open the blister; in fact, usually, every care is taken to preserve the bleb intact and allow the

fluid that has accumulated under the raised epidermis to be absorbed, opening the bleb simply affording a surface that can become infected. If, however, the physician desires the bleb opened, make a small slit in its lowest corner with a pair of sterile scissors and catch the escaping fluid with a sterile sponge; make slight pressure on the bleb with a sterile sponge to press out the fluid that does not pass readily through the incision. Whether the blister is opened or not, apply a sterile dressing; this often consists of sterile zinc oxide or boric acid ointment spread on sterile lint or gauze. If proper aseptic precautions are taken the wound should heal without the formation of pus and without leaving any scar.

To apply cantharidal collodion, wash and disinfect the skin as when using a plaster. Outline the space to which the vesicant is to be applied with oil in order to prevent the latter spreading. Apply the collodion with a camel's hair brush or cotton swab, allow it to dry, and then cover it in the same way as a plaster. After the blister forms, remove the collodion by washing the part very gently with ether. Treat the blister in the same way as that caused by a plaster.

Local Applications Other than Counterirritants

Antiphlogistin.—This substance is now often used for the relief of pain due to congestion. How it does this is not understood because its composition, beyond that it is a variety of Denver mud with certain medicinal ingredients incorporated, is unknown, except to the compounder. To use antiphlogistin, spread it about a quarter of an inch thick upon a piece of old muslin the required size, place this upon

a plate or tray and put it under a gas jet or in a *warm* oven to heat; or else put as much of the antiphlogistin as will be required in some small receptacle and stand this in a saucepan of boiling water; keep the water boiling until the antiphlogistin is thoroughly heated, then spread it on a piece of muslin. Keep it in position on the part to which it is applied with a binder or bandage, and over this place a hot-water bag. The application is usually left on until the antiphlogistin becomes hard and dry, which will not happen for several hours. When the antiphlogistin is removed, wash the skin with hot water and soap.

Ointments.—Ointments are applied either by spreading them on gauze, lint, or soft muslin, or by inunction. The former method is used when the skin is broken. The application is held in place with a bandage. When the latter method is employed, first wash the skin with soap and hot water in order to remove all fatty substance from the skin, for this prevents absorption; then rub the ointment, taking a little at a time, over the prescribed part until the required amount has been absorbed. Before using mercurial ointment for inunction, protect your hand with a rubber glove, or you may become salivated; and as patients getting mercurial inunction usually are being treated for syphilis, take every precaution against infection. Another point to remember in connection with the use of mercurial inunction is that mercury is irritating to the tissues and, therefore, the application must not be made in the same place until several days have elapsed. The application is made in those parts of the body where the skin is thinnest, such as the inner surface of the elbow joint, the groin, the inner surface of the thighs, and, in order to pre-

vent the inunction being made to the same part too soon, the part to which it is made should be recorded on the patient's chart.

Cold

Action.—Cold is frequently employed in the treatment of inflammation, because, on account of its depressing action on protoplasmic cell activity, it inhibits the activity of bacteria and thus prevents them multiplying or forming toxins. Also, cold relieves pain by (1) causing contraction of the blood-vessels and thus relieving congestion; (2) by lessening the irritability of the sensory nerve-endings.

Methods of Applying Cold.—Cold is generally used in the form of ice, or of iced or cold water or solutions. It is most commonly applied by the use of ice caps, ice coils, compresses, local baths, or irrigations.

Ice Caps.—These are bags made of rubber or of Japanese paper. Various shapes can be obtained: long, narrow ones for the throat, helmet-shaped ones to cover the head, and oval or round ones.

To fill an ice cap, break the ice into pieces about the size of a walnut; let some hot water run over it, to blunt the sharp edges, which might pierce the rubber; roll up the cap before putting in the ice, in order to expel the air, and for the same reason, after filling the cap, squeeze it above the ice before putting on the cover. Do not fill a cap more than three quarters its capacity and not even this much if it is to cover a painful part. Put the cap in a muslin protector or, if such cannot be had, envelop it in gauze or a thin handkerchief; never put the rubber directly upon the

skin or the part may be frozen. Caps are provided with small loops so that they can be tied in place with a bandage if required. If the weight of the bag troubles the patient it will be necessary to improvise some way of suspending the cap above the part in such a way that it will barely rest upon it. A bed-cradle is often of use when it is necessary to do this, the cradle being put over the part and the cap tied to it. After use, dry a rubber cap well and put a piece of gauze in it so that its sides will not stick together. Be sure that the rubber washer is on the cover or it may be lost. If caps are not likely to be used for a long time it is well to put talcum powder in and over them.

Japanese paper caps are of lighter weight than the rubber caps. They can be used only for a short time, but as they are inexpensive this does not make them more costly than the rubber caps when they are not likely to be used for any length of time, as for home use.

In the country, when a rubber or paper cap cannot be obtained, a bladder can often be bought at the butcher's and it will prove an excellent substitute.

Ice Coil.—The so-called ice coil consists of rubber tubing about one quarter of an inch in diameter held in a coil with narrow bands of rubber[1] and having two loose ends about two yards long for the passage of ice water to and from the coil.

To use the coil, attach a funnel to the end coming from the center of the coil and place the other end in a pail stood on a stand or the floor at the side of the

[1] A coil can be easily made by coiling the tubing in the same way as the bought coils, putting three or four rows of tape on either side the tubing and stitching each of the two pieces of tape together at the lower edge of each circle of tubing.

bed; it is well to secure this end in place with a small piece of adhesive plaster. Place a pail of water and ice on a stand at the side of the bed. The pail should be about two feet above the patient. The ice, unless perfectly free from foreign substances, should be rolled in a piece of old muslin or gauze as, otherwise, the tube might soon become blocked. Unless a regular cover is provided for the coiled part of the tubing, arrange a towel or doubled compress of gauze around it so that the rubber will not come in contact with the patient's skin.

To start the water running through the tubing, fill the funnel with water and before it has all run through the funnel turn the latter into the pail of water.

Compresses for the Head.—A common way of applying cold to the head is by means of compresses. To make a compress, fold, separately, two pieces of gauze or old handkerchiefs so that they will not be wide enough to wet the hair or come down over the eyes nor long enough to wet the pillow. If gauze is used turn in the edges that loose threads may not annoy the patient. Place a block of ice with a very little water in a small basin, wring out the compresses in water and place them on the ice until cold. Keep one compress on the ice while the other is on the head; change the compresses as often as required.

Compresses for the Eye.—These are usually made of absorbent cotton or of two or three thicknesses of lint cut just a little larger than the eye. A compress for the eye must not come over the bridge of the nose and if both eyes are to be treated a separate compress must be used for each eye. When there is discharge from the eye, the same compress must not be used twice and a receptacle must be provided for

the discarded compresses. If the compresses are to be continued for any length of time, it is well to put something in the bottom of the basin to raise the ice out of the water as, then, it will not melt so quickly.

Leeches

Leeches are not now used as much as formerly, but they are employed occasionally, especially to relieve congestion around the eye and ear.

To apply a leech, first wash and disinfect the skin as when an incision is to be made. Place the leech in a test-tube or small bottle, with its head to the opening, and invert the tube over the prescribed spot; do not place it where a vein can be seen. If the leech does not take hold readily, rub the patient's skin with a little sweetened water, or prick the skin with a sterile needle so as to extract a drop of blood. After the leech takes hold, do not attempt to pull it off, or its sucker may be left in the wound and a serious inflammation result; it will let go of itself when filled. If, however, it is desirable to take it off sooner, sprinkle a little salt on its tail. A leech will take about a dram of blood, but as much as an ounce or more can be extracted if hot sterile compresses are applied to the part after the removal of the leech; in fact, it is always necessary to watch for hemorrhage after the use of a leech, because the tissues sometimes become infiltrated with a liquid secreted by the leech which prevents the coagulation of blood. When this occurs a piece of sterile cotton or gauze saturated with adrenalin or other astringent is bandaged over the part. After the bleeding is checked a sterile gauze dressing is applied.

Leeches are kept in a jar of water that has a little sand in the bottom and is provided with a perforated cover until about an hour before they are wanted, but a leech will take hold better if it is removed from the water this long beforehand. It can be kept in the tube that will be used to apply it, if a piece of doubled gauze is tied securely over the opening. A leech is never used a second time and should be killed and burned after use.

CHAPTER XVII

ADMINISTRATION OF MEDICINES

Things that Nurses should Know Regarding Drugs and their Administration. Abbreviations Used when Writing Prescriptions. Chemical Symbols. Different Methods of Administering Drugs. The Absorption of Drugs. The Doctor's Order Book. Medicine Lists. Important Rules to Remember in the Care and Administration of Medicines. Technique and Precautions Necessary in Giving Medicine Subcutaneously. Different Methods of Giving Medicine by Inhalation. Technique of these Methods. Suppositories. Some Methods Used when Applying Medicine to the Eyes.

Things that Nurses should Know about Medicines and their Administration

SOME of the more important things for nurses to know about drugs are as follows: Nurses should have some idea of (1) the physiological action of the medicines in common use, otherwise they will not know what effects to watch for after the administration of a drug. (2) They should know the minimum and maximum doses of drugs, especially poisonous ones, for such knowledge should help to prevent mistakes. (3) They should know the treatment for poisoning by the various classes of poisons. (4) They should know the signs of overdosing by drugs, because it is necessary to be always on the watch for such symptoms for the following reasons: (*a*) some people

have an intolerance for certain drugs and very small doses may cause poisoning; (*b*) some drugs are not readily excreted and thus tend to accumulate within the system and may cause poisoning, unless the first symptoms of over-dosing are recognized, and even drugs which do not accumulate in the body may produce undesirable effects when taken too long, as is likely to happen unless the nurse observes primary symptoms of disturbances and reports them to the doctor. (5) Another very important thing for nurses to appreciate in connection with drugs is the danger of patients contracting the drug habit; this is especially the case with cocaine and with drugs used to alleviate pain, as morphine, and to induce sleep, as chloral. For this reason nurses should make it a rule not to give an anodyne or narcotic, the giving of which has been left to their discretion, until they have tried all other means of mitigating pain or inducing sleep.

Some important things for nurses to know in connection with the administration of medicines are as follows:

The method of estimating how much of a medicine to give when the preparation on hand contains a different fractional part of a grain of the drug than that ordered; *e. g.*, the dose ordered is $\frac{1}{25}$ of a grain of strychnine and the solution on hand is one in which each 10 minims contains $\frac{1}{30}$ of a grain—to find out how much to give, multiply the denominator of the fraction of the amount of drug contained in the solution on hand by the number of minims containing it and divide the result by the denominator of the fraction of the amount of drug that is to be given. Thus: $30 \times 10 = 300 \div 25 = 12$. Therefore by giving 12

minims of a solution of which each 10 minims contains $\frac{1}{30}$ of a grain of the drug, you will give $\frac{1}{25}$ of a grain.

To reckon a child's dose: Make a fraction, taking the child's age for the numerator and the child's age plus 12 for the denominator and this fraction will be the fractional part of an adult dose that should be given a child of that age. Thus a child of 8 should be given $\frac{8}{20}$ or $\frac{2}{5}$ of the adult dose.

The symbols and abbreviations used in writing prescriptions that it is well for nurses to know are as follows:

Abbreviation	*Derivation*	*Meaning*
āā.,	ana,	of each.
A. c.,	ante cibum,	before meals.
Add.,	addo,	add.
Ad lib.,	ad libitum,	as much as desired.
Alt. dieb.,	alterius diebus,	every other day.
Alt. hor.,	alterius horis,	every other hour.
Alt. noc.,	alterius nocta,	every other night.
Aq. dest.,	aqua destillata,	distilled water.
Aq. pur.,	aqua pura,	pure water.
B. i. d.,	bis in die,	twice in a day.
C.,	congius,	a gallon.
C.,		centigrade.
c.,	cum	with.
C.c.,		cubic centimeter.
Cap.,	capiat,	let him take.
Decub.,	decubitus,	lying down.
Dil.,	dilutus,	dilute.
F.,		Fahrenheit.
F.,	fac,	make.
Fld.,	fluidus,	fluid.
Ft.,	fiat,	let it be made.

Abbreviation	*Derivation*	*Meaning*
Gm.,		gram.
Gr.,	granum, grana,	grain, grains.
Lb.,	libra,	pound.
Liq.,	liquor,	liquid.
M.,	misce, mistura,	mix, mixture.
M.,	minimum,	a minim.
O.,	octarius,	a pint.
Ov.,	ovum,	egg.
P. c.,	post cibum,	after meals.
P. r. n.,	pro re nata,	as occasion arises.
Pulv.,	pulvis,	a powder.
Q. h.,	quaque hora,	every hour.
Q. s.,	quantum sufficit,	as much as is sufficient.
℞.,	recipe,	take.
S. or sig.,	signa,	give the following directions.
S. o. s.,	sic opus sit,	if necessary.
Sp. gr.,		specific gravity.
Ss.,	semi, semissis,	one-half.
S. v. r.,	spiritus vini rectificatus,	alcohol.
S. v. g.,	spiritus vini gallici,	brandy.
S. f.,	spiritus frumenti,	whiskey.
T. i. d.,	ter in die,	three times a day.
Tr.	tinctura,	tincture.
Ung.,	unguentum,	ointment.
μ,	micron,	the millionth part of a meter.
ʒ,	drachma,	dram.
℥,	uncia,	ounce.
℈,	scrupulum,	a scruple.

Chemical Symbols

Also, it is well for nurses to know the chemical symbols for the more common elements and of a few compound substances for which such symbols are frequently employed. The symbols used for the elements consist of the initial letter of the Latin name of the element and, when two or more elements have the same initial letter, a second letter; in such case, the single letter symbol is reserved for the most common element. In the symbols used for compound substances, each letter represents one atom of the element for which the letter stands, when there is more than one atom of any element in the compound the fact is indicated by a number, thus H_2O shows that in one atom of water, for which H_2O is the symbol, there are two atoms of hydrogen and one of oxygen; $KClO_3$ shows that each atom of potassium chlorate contains one atom of potassium, one atom of chlorine, and three of oxygen.

Some of the Common Elements and their Symbols

TABLE OF COMMON ELEMENTS AND THEIR SYMBOLS

Aluminum	Al	Iron (Ferrum)	Fe	Phosphorus	P
Arsenic	As	Lead (Plumbum)	Pb	Potassium	K
Calcium	Ca	Magnesium	Mg	Silver (Argentum)	Ag
Carbon	C	Manganese	Mn		
Chlorine	Cl	Mercury (Hydrargyrum)	Hg	Sodium (Natrium)	Na
Gold (Aurum)	Au				
Hydrogen	H	Nitrogen	N	Sulphur	S
Iodine	I	Oxygen	O	Tin (Stannum)	Sn

CHEMICAL SYMBOLS OF SOME COMPOUND SUBSTANCES

Acetic Acid	$C_2H_4O_2$
Alcohol (Grain)	C_2H_6O

Alcohol (Wood)	CH_4O
Ammonia (Gas)	NH_3
Ammonia (Aqua Ammonia)	NH_4OH
Carbon Dioxide	CO_2
Carbon Monoxide	CO
Hydrochloric Acid	HCl
Lime Water (Aqua Calcis)	$Ca(OH)_2$
Potassium Chlorate	$KClO_3$
Salt (Sodium Chloride)	$NaCl$
Starch	$C_5H_{10}O_{5n}$
Sugar Cane	$C_{12}H_{22}O_{11}$
Sugar Glucose	$C_6H_{12}O_6$

The Administration of Medicine

Methods of Administering Drugs.—The ways in which drugs are most commonly administered are by mouth, inhalation, inunction, and subcutaneously.

The Absorption of Drugs.—The length of time required for the absorption of medicine depends upon the nature of the drug, the way in which given, the condition of the patient's blood circulation, and, if the medicine is given by mouth, whether the stomach is empty or full.

Medicines given subcutaneously are absorbed almost immediately, as are also those given by inhalation, owing to the great number of blood-vessels in the lungs. Drugs given by rectum are absorbed more slowly and less fully than those given by mouth; larger doses are, therefore, usually given when drugs are administered in this way.

When Drugs are Administered.—Bitters and other drugs used to stimulate the appetite are given before meals. Alkalies are also given before meals when they are intended to stimulate the flow of gastric juice, but they are given after meals when they

are required to neutralize the acidity of the gastric juice. Acids and other irritating drugs such as arsenic, bromids,—when they are given continuously for any length of time,—iron, iodids, and mercury are given between half an hour and one hour after meals. Medicines given for local effect upon the stomach are given when the stomach is empty. Laxatives that act slowly are given at night and those which act more quickly are administered in the morning, usually before breakfast. Hypnotics are generally given in the evening: how long before the hour for sleep depending upon the drug, for some hypnotics will take effect in half an hour and others not for two or three hours.

The Doctor's Order Book

It is a wise rule of many hospitals, that a "Doctor's Order Book" be kept in each ward, and that, except in emergency, no medicine be given, the order for which has not been first written in this book by the doctor. In these hospitals a nurse is allowed to write the orders, but the doctor must read them and sign his name to them.

Medicine Lists

There are a variety of methods used in hospitals for keeping the list of the medication that is to be given. Two of those most generally used are as follows:

Method I.—This method originated in St. Luke's Hospital, New York. It consists in having tickets, two inches square, of colored cardboard, a different color or shape being employed for each time of administration. Thus: red signifies every four hours;

red, with a corner off, every two hours; pink, every three hours; yellow, after meals; blue, before meals; white, every night; white, with a corner off, every morning, etc. On these tickets are written the patient's name, the name and dose of the medicine, and the hour of giving. They are kept in the medicine case, each color and shape together. As soon as the medicine is poured out, the ticket is placed on the medicine glass and must not be taken off until the medicine is given to the patient. When giving out a number of medicines at the same time, each ticket is to be read before it is taken off the glass. New tickets are made out and old ones destroyed as soon as medication is ordered or changed, a check being made in the Doctor's Order Book to show that this has been done. The tickets to be destroyed are doubled and left on the head nurse's table. They must not be thrown away, and new tickets must not be put into the medicine case, until the nurse in charge of the ward has compared them with the order book.

Method II.—Another method of administering medicine is to have the medicine tray marked in numbered squares. The beds in the wards are distinguished by corresponding numbers, and the medicine for each patient is placed in the square bearing the number of his bed. The nature of a medicine list often used in connection with this method is shown in Fig. 29.

Important Rules to Remember in Connection with the Care and Giving of Medicines

There are a number of important rules to remember in connection with the care and administration of medicine; viz.:

1. Especially in hospitals, drugs should be kept in

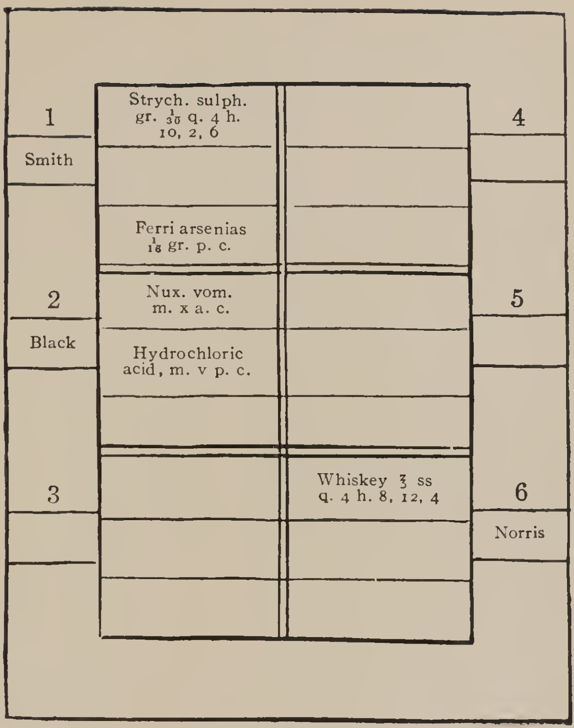


Fig. 29

The holder for the medicine list consists of a flat piece of metal painted with white enamel, of sufficient size to be divided into as many spaces about 2 in. sq. as there are beds in the ward. The holder is surrounded with a frame. This frame is only attached to the foundation at the points of the metal strips which divide the squares, in order to leave a space between the two to allow of the insertion of the cards bearing the name of the medicine, etc. The squares are subdivided by narrow strips of grooved metal so that a separate space can be allotted to the several times when the medicines are to be given and differently colored cards should be used for the various times of administration. The frame is provided with grooved strips to hold the patients' names and the numbers are painted on it in black or other dark color paint.

a locked case, and the key should not be kept in the lock. In many hospitals it is a rule that, at night, the nurse should carry the key.

2. It is well to keep the drugs in the medicine ease in alphabetical order, but with bottles of the same size together, and with all the more powerful drugs apart from others and in bottles with a rough exterior or other distinguishing feature and marked *poison*.

3. Keep oils in a cool place.

4. Never have medicines in unmarked bottles nor use a dose of medicine that has been left in a glass unmarked.

5. Never order a large amount of medicine; there are few drugs that will not deteriorate with age.

6. Give medicines on time.

7. While measuring medicines, never think of anything but the work on hand and never speak to any one nor allow any one to speak to you.

8. Use graduated glasses and pipettes, not spoons, for measuring.

9. Measure minims, when minims are ordered, and drops, when drops are ordered, for there is often a marked difference between the two.

10. Measure exaetly; never give a patient one drop more or less than the amount ordered.

11. Read the label on the bottle thrice, before taking it from the shelf and before and after pouring out the medicine.

12. Always shake the bottle before pouring out the medieine.

13. While pouring the medicine, hold the medicine glass with the mark of the quantity you require on a level with your eye. If the mark is above your eye, you will give too little, if below, too much.

14. Always re-cork bottles immediately after use; many medicines contain volatile substances and will become either stronger or weaker if left uncorked.

15. To avoid defacing the label while pouring the medicine, hold the bottle so that the label will be on the upper side, but do not let your hand come in contact with it; and, before replacing the bottle on the shelf, wipe the rim of the former with a piece of gauze kept for the purpose.

16. Never mix, nor give at the same time, without speaking to the doctor, medicines which change color or form a precipitate when put together, for, when they do so, a chemical change has probably taken place in their composition.

17. Give acids and medicines containing iron through a glass tube or straw; because acids corrode the enamel of the teeth and iron discolors it.

18. When giving medicine to an unconscious patient, drop it far back on the tongue, using a small spoon (never a glass, for the purpose), and dissolve powders or pills before giving them.

19. Never allow one patient to carry medicine to another—innumerable mistakes have been thus made.

20. There are certain points regarding the diluting of medicines that it is important to remember, viz.: Syrup cough medicines are usually given undiluted, because the soothing effect of the syrup on the mucous membrane will be minimized if the medicine is diluted. Saline cathartics, especially when given to aid in the removal of fluid from the tissues, should be very sparingly diluted and the patient should be given very little water until the salts have been effectual. On the other hand drugs likely to irritate the mucous membrane of the stomach and intestine should be very

well diluted. Of this class are arsenic, the acids, the bromides, iodids, and iron.

21. Make a dose as palatable as possible; to this end use either very cold or very hot water for diluting medicine; give bad tasting powder in capsules[1] or konseals; when nothing of the kind can be obtained the powder usually can be given in syrup, jam, or honey; if a powder is given by putting it on the tongue be sure and arrange the paper in which it is so that the powder will leave the paper readily, put the powder far back on the tongue, and have a large glass full of water at hand. Oils, except oleum tiglii, can be given in lemon juice and vichy, or wine and vichy, and, as they have less taste if very cold, it is well to put a small piece of ice into the glass when preparing the dose, and allow it to melt until it is small enough to be easily swallowed. Only add the vichy just before giving the dose to the patient; do not put much with the oil but have some in a separate glass to give the patient as soon as the oil is swallowed. It is not well to give oil in hot milk and coffee as is sometimes done, because it is likely to make the patient dislike these things, especially milk. Oleum tiglii (croton oil) is usually given on sugar or in melted butter.

22. Some foods must be withheld or given only in small amount when certain drugs are being employed; *e. g.*, milk or eggs should not be given shortly before nor soon after a dose of calomel or they will combine

[1] Capsules, konseals, and similar agents for giving medicine are usually made of gelatine or other substance which will dissolve in the stomach. They consist of two parts; those of the capsules fit one into the other and after being filled they are joined in this way; other varieties require to have their edges moistened with water in order to make the two parts adhere.

with the drug and form an albuminate of mercury which will be ineffectual; also sodium chloride and foods containing it should not be given near a dose of calomel, for the mercury and sodium chloride will react chemically and form a poisonous compound. Starch and iodin unite to form an iodid of starch, consequently starchy foods are limited, or else not given near the medicine hour, when a patient is getting iodin preparations.

Hypodermic or Subcutaneous Injections

When Given.—Medicine is given subcutaneously: (1) when prompt action is required; (2) when, for any reason, it cannot be taken by mouth; (3) when the secretions of the stomach or intestine interfere with the action of the drug.

Nature of Drugs Used for this Purpose.—Drugs intended for hypodermic use are generally specially prepared; they are put up in a concentrated form and great care is taken to have them pure and sterile. Some drugs intended for this use are put up in the form of compressed tablets and require to be dissolved. This must be done by putting the tablet into warm, sterile, distilled water. Distilled water must be used because some of the various salts, always present in water that is not distilled, may unite chemically with the drug and change its nature.

Dangers Attending the Giving of Medicine Subcutaneously.—These are: (1) the formation of abscesses, (2) the breaking of the hypodermic needle in the flesh, (3) the injection of the drug into a vein.

Means of Averting these Bad Results.—To avoid causing an abscess: (1) Do not use drugs that

you do not know to be pure and sterile; (2) sterilize the hypodermic syringe and needle carefully; (3) clean the patient's skin thoroughly where the puncture is to be made; (4) avoid all irritation of the subcutaneous tissue, because if such is caused and there are germs in the skin ducts and glands (as is likely to be the case) an abscess is very apt to occur. Two of the ways of causing irritation are: (1) using a blunt needle; (2) injecting the fluid so superficially that it is in contact with the nerve endings in the skin. It is especially important to inject such irritating medicines as digitalis, ergot, quinine, and arsenic preparations very deeply into the muscles. To avoid risk of breaking a needle in the flesh: (1) do not use a bent needle; (2) if the patient is conscious and has never had a hypodermic injection, tell her what you are going to do and that it will not hurt more than the prick of a needle; otherwise, she is likely to jump and thus break the needle; (3) do not, if possible to avoid it, ever attempt to give a hypodermic to a delirious patient without some one to hold her; (4) do not make an injection over a bony prominence. That the drug be not injected into a vein, never make an injection where the veins can be seen nor where large blood-vessels are known to be near the surface. The best locations in which to make injections will be discussed on page 439.

Methods of Sterilizing Hypodermics and Syringes.—In the majority of hospitals the needles are sterilized by boiling them for one minute; the syringes, if of glass, are sterilized in the same way; if they are of metal and glass, with rubber washers which would be ruined by boiling, by alternately filling them with and expelling alcohol 70 per cent.

In some hospitals, except when the instrument is used for patients suffering from infectious diseases, both needle and syringe are sterilized with alcohol 70 per cent., the needle being attached to the syringe and the alcohol alternately drawn up into the syringe and expelled from it six times, care being taken not to let the needle come in contact with the jar containing the alcohol. The advantage of this method is that the needle does not become blunted as soon as it does when it is boiled, and several years' trial in a number of hospitals has shown, that if the needle and syringe are sterilized in the same way after use and kept on sterile gauze in a small, clean, covered glass jar or in 95 per cent. alcohol, they will be quite as effectually sterilized by the alcohol as by boiling. When injections are being given constantly or when, for any reason, the hypodermic is likely to be needed in a hurry, it is well to keep syringe and needle covered with 95 per cent. alcohol in a small covered jar; they are then ready for instant use.

Necessary Care of Hypodermic.—The needle point is easily blunted; therefore, it must not be allowed to come in contact with any hard surface. The inside of a needle will become rusted unless it is carefully dried after use and put away with a wire in it. To dry a needle, immediately after sterilizing it, insert a wire and then remove it and dry it on a piece of gauze; repeat the process until the wire, when removed, is perfectly dry, then reinsert it and allow it to remain in the needle. If, as is often the case, there is a loop on one end of the wire, the wire must be so inserted that the loop will be at the screw end, and not the point, of the needle. When glass syringes with pistons provided with asbestos packing are used, the

asbestos must be thoroughly moistened before it is inserted in the barrel, otherwise, as the asbestos occupies more space when dry than when wet, if the piston is forced into the barrel the latter will be broken.

METHODS OF FILLING A SYRINGE.—When a metal syringe from which the piston cannot be removed is used, after the syringe is sterilized, the medicine, if liquid, is drawn into it by one of two methods: (1) the syringe is fitted into the neck of the bottle and the bottle tilted as much as necessary to bring the solution into contact with the syringe, the piston is then very slowly drawn up until there are one or two minims more than the required amount in the syringe; (2) one or two minims more than the required quantity of medicine is measured in a sterile minim glass and this is drawn into the syringe by very slowly pulling up the piston.

After the syringe is filled, it is turned so that the needle is pointing upward; the piston is then pressed very gently until its lower edge is on a level with the line showing the amount required; doing this expels the extra two minims and with them the air. If more than one or two minims are drawn into the syringe the extra amount, after the air has been expelled, should be returned to the bottle by holding the syringe, needle downward, over, but not touching, the bottle and pressing the piston. If air bubbles are seen in the liquid after these directions have been carried out, some part of the syringe must be too loose.

When a syringe is used from which the piston can be removed, it is filled by, after it is sterilized, adjusting the needle, removing the piston, pouring in the medicine—one or two minims more than necessary—and then very gently inserting the piston, holding the

barrel obliquely until the piston is in far enough to prevent the medicine escaping and then turning it, needle upward, and proceeding as when the other kind of syringe is used.

Method of Giving Two Drugs at the Same Time.—Occasionally two drugs are ordered to be given together; one way of filling the syringe in such case is to proceed according to the directions already given, also, to measure the *exact* amount of the second drug required in a sterile minim glass and, after the air has been expelled from the syringe, to draw the medicine in the minim glass into the hypodermic by holding the needle in the liquid and pulling up the piston *very slowly*. Great care must be taken: (1) not to draw up the piston more than is necessary to get the fluid into the needle—otherwise air will be sucked in; (2) not to let the needle press against the bottom of the glass, for doing so will blunt the point.

Method of Measuring Small Doses.—It is often impossible to measure very small amounts (two or three minims) in a syringe, and in such case it is well to measure about four minims of the medicine in a sterile minim glass, add an equal amount of sterile distilled water, and then draw up twice the amount of medicine ordered into the syringe.

Method of Preparing Tablets for Hypodermic Use.—If the piston of the syringe can be removed, put the tablet with about ten minims of sterile, distilled water, in the syringe, attach the needle, insert the piston, expel the air, and shake the syringe until the tablet is thoroughly dissolved, being careful not to let the needle touch anything.

If the piston cannot be removed, dissolve the tablet

in the water in a sterile minim glass and draw it into the syringe in the usual manner.

As a rule, boiling water should not be used to dissolve tablets, because a high degree of heat causes chemical changes in many drugs. The majority of tablets, if in a suitable condition for use, will be easily dissolved in cold or slightly warmed water.

Hypodermic Tray.—In many hospitals, after the syringe is filled, it is carried to the patient on a small tray kept for the purpose and holding: a small covered glass jar filled with sterile gauze sponges, another containing alcohol 70 per cent., or whatever disinfectant is used for cleansing the skin, and a small glass tray to receive sponges after they have been used. When the hypodermic is ready, a sterile sponge is laid on the tray and the syringe placed on this in such a way that the needle is raised above the tray and does not come in contact with anything.

Locations for Injections.—Subcutaneous injections must not be given on the inner surface of the legs or arms, over a visible vein or a bony prominence. Unless otherwise ordered, nurses are usually expected to give hypodermic injections on the outer surface of the arms or thighs; with a very thin patient the latter location is the better of the two. Injections are given also into the muscles of the abdomen and those of the chest—below the breast—and irritating medicines such as quinine and arsenic preparations are generally injected into the glutei muscles and are given with a long needle, but nurses should not inject drugs in these locations unless told to do so by the doctor.

Method of Giving Injection.—Wash the part in which the injection is to be given very thoroughly with alcohol 70 per cent. or other disinfectant, stretch

the skin tightly over the part by pressing upon it, in one direction with the thumb, and in the other with the first finger of the left hand. Sometimes, when a patient is very thin, it is necessary to take up a cushion of flesh between the thumb and fingers; when this is done, the muscle and not just the skin and superficial tissue must be grasped and the skin must be stretched as before, for when the skin is loose it interferes with the entrance of the needle and pain is caused. After thus preparing the part, put the needle, *almost vertically*, quickly into the tissue; much less pain is caused if the needle is put in quickly than if it is passed in slowly. Never touch the piston while you are inserting the needle, or you may press out some of the medicine before it is time. After the needle is in, press the piston slowly and thus inject the medicine into the tissue. Wait a second, and then remove the needle quickly, holding the skin stretched or else making pressure near the point of puncture while doing so. Massage the part for a few seconds so as to disperse the fluid through the tissue and to hasten its absorption.

Care of Hypodermic Syringe after Use.—Sterilize the instrument in the same way as before use. If the piston can be removed, take it out; this is very important with pistons in which the packing expands when dry. Dry the needle as directed on page 436, and put it away with the wire in it. It is well to keep the needles between layers of sterile gauze in a small jar that can be washed and sterilized.

The Giving of Medicine by Inhalation

On Cones.—Certain volatile substances, as nitrate of amyl, creosote, ammonia, chloroform, etc., are

often given by sprinkling a few drops on a mask, of which there are many varieties, or, in emergency, a gauze compress or handkerchief and holding this over the patient's nostrils and mouth. When chloroform is used, as much of the face as will be covered by the mask should be greased with vaseline or oil, for, otherwise, chloroform is likely to blister the skin.

With Steam.—Other volatile substances as tincture of benzoin, oil of eucalyptus, etc., are put into boiling water and the steam, and, with it, the essence of the drug inhaled. Such inhalations are given in a number of ways, some of the more common are as follows:

1. **With a Maw's inhaler.** This is a carafe-shaped utensil, the mouth of which is fitted with a cork that has a hole in the center, into which a glass mouthpiece fits. From the side of the carafe a small open projection extends which is intended for the entrance of air, this being necessary to force the steam up. To prepare an inhalation in a Maw's inhaler: heat the utensil by pouring hot water into and over it; then pour in enough *boiling* water to about half fill it (the water must not come above the opening of the air channel), add the drug, insert the cork with the mouthpiece attached, and wrap a doubled piece of flannel or a bath towel around the inhaler, leaving the mouthpiece and the air channel uncovered.

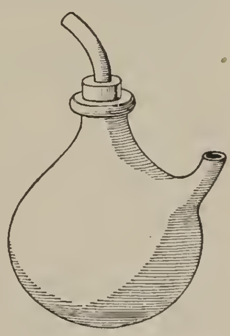


Fig. 30. Maw's Inhaler

2. **A pitcher** is sometimes substituted for the

Maw's inhaler, but it does not retain the heat so well nor is it as convenient to use.

3. **A croup kettle** is often used. This is a kettle with a long spout; the water and drug are put into the kettle, which is placed on a stand over an alcohol lamp or on a gas or electric stove, so that the water will be kept boiling. If a large funnel or cone is fitted into or over the free end of the spout it will be possible for the patient to get the steam more easily.

4. In emergency, an **ordinary kettle** is often substituted for the croup kettle, and a large cone made of heavy paper, cardboard, or other stiff material, fitted over the spout.

When giving inhalations by either of the last two methods, if the patient is in bed, put some kind of a non-inflammable protector between the flame and the bedclothes.

5. **Croup tents,** so called because they are so commonly used in the treatment of croup, are frequently used in any case in which it is desired to have the patient breathe warm, moist air with, or without, the addition of some volatile medicinal substance. Such tents are made in a variety of ways, and the best way to make one depends upon the kind of support that can be procured. In some hospitals, special frames are provided; in others, the screens are used; in private nursing, old screens or an umbrella can be made use of.

Figures 31 and 32 show tents made over iron frames that are attached by means of hooks to the top of the bed. The canopy in Fig. 31 is made by covering the frame with a piece of old blanket and this with a doubled sheet; this is pleated at the sides and pinned so as to make the sheet fit snugly across the front and

over the top of the frame; a second sheet, doubled, is then put around the back and sides and pinned at the top to the first sheet and blanket. The pins are put quite near together; *i. e.*, not more than an inch apart. In the tent shown in Fig. 32 the steam is introduced

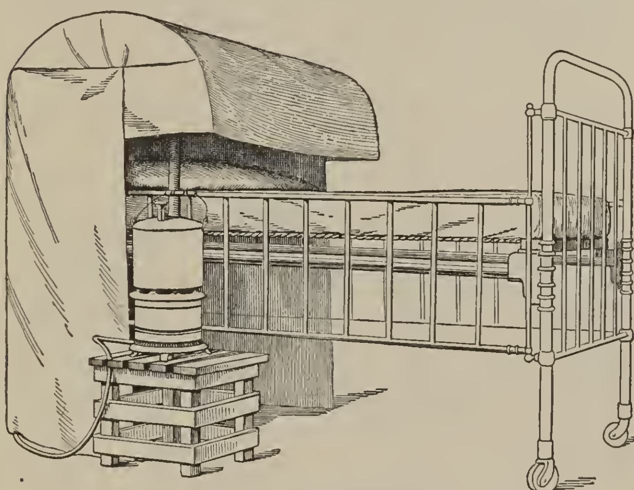


Fig. 31. Croup Tent

at the back of the bed. The tent is made by covering the top of the frame with a piece of old blanket, which is pinned around the outer edge of the frame. Two sheets are spread on a table right sides together and pinned down the center, the pins being put not more than a quarter of an inch apart; each sheet is then folded back upon itself, and they are draped over the frame as shown in Fig. 32. One or two pins are removed from the seam where the spout of the kettle is to enter. This must be at a distance above the

patient's head and the spout must not be inserted more than one-half inch.

When a screen is used, it is arranged around the back and upper part of the sides of the bed or crib. Doubled sheets are pinned or otherwise attached around on the inside of the screen; a piece of strong bandage or cord is tied to the top of the outer edge of

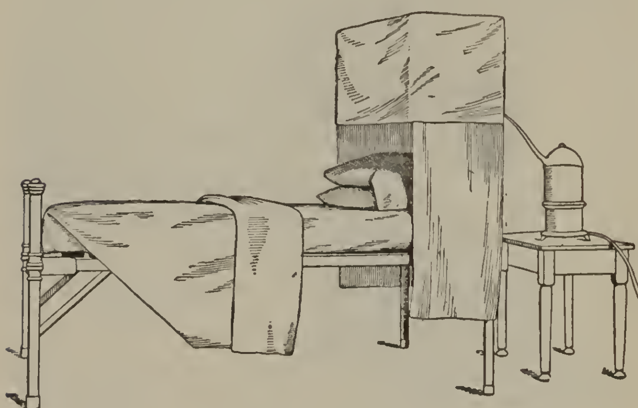


Fig. 32. Croup Tent

each of its side wings, across the bed, in order to afford a support in front for the top covering. This should consist of an old blanket covered with a sheet and the sheet should be folded neatly around the corners of the screen and pinned.

The important points to remember in connection with the use of steam in this way are: (1) That the spout of the kettle must not extend under the canopy far enough for the patient to touch it or for the steam to come directly against the patient; (2) that there must be a protector between the bedclothes and the

flame of the stove; (3) that a blanket is to be put over the top of the tent, otherwise there will be nothing to absorb the moisture, and it may condense and drops of water fall upon the patient and bed.

Method of Preparing a Calomel Inhalation.—Calomel inhalations are occasionally used in the treatment of diphtheria and syphilitic conditions of the throat. To prepare for one: place an alcohol lamp in a deep basin, over this place a metal stand or, if such cannot be obtained, place on the basin either a piece of strong wire netting or a piece of tin or a thin asbestos mat with holes perforated in them (to admit air to the lamp), or a couple of metal rods, and put a tin plate containing calomel powder on this support. Place this apparatus on an old chair at the side of the bed, near the head, and arrange a canopy which will include the table and upper part of the bed. When a canopy is arranged for this purpose the sheet must reach to the bedding so that the calomel fumes will not escape, and it must be possible to draw a corner aside from time to time to watch the patient. It is not necessary to use a blanket. When everything is in order, light the lamp. Be careful not to inhale the calomel fumes, which are given off as soon as the drugs become heated, for a person in normal condition will become salivated by so doing. The length of time that the inhalation is to be continued will be ordered by the doctor.

Stramonium Inhalations.—Such inhalations are sometimes prescribed for the relief of asthmatic spasms. To give a stramonium inhalation, put the stramonium leaves into a bowl that will not be broken by heat; arrange a cone that will fit over the bowl, it can be made of stiff paper; apply a lighted

match to the leaves; adjust the cone and have the patient inhale the smoke through its free end.

Oxygen Inhalations.—Oxygen is sometimes given by inhalation when a patient is not getting sufficient from the air. Cyanosis is an indication that this is the case. Such inhalations are not now used as much as formerly, however, because it is not now thought that much of the oxygen given in this way passes into the blood.

The articles necessary for the giving of such inhalations consist of a tank containing oxygen, a thick glass flask about nine inches high with a wide neck into which is fitted a cork containing two holes, and in each hole a glass tube bent almost to right angles. The flask is half full of water, one of the glass tubes must extend into the water, almost to the bottom of the flask, the other should be only two or three inches through the cork and a distance above the water. The free end of the longer glass tube is attached to a piece of rubber tubing, the other end of which is slipped over the faucet on the oxygen tank; another piece of rubber tubing long enough to reach from the flask of water, when it is standing on a table by the bedside, to the patient's mouth, is attached to the shorter of the two bent tubes, and a funnel is fitted into its free end. It is important to get the tubes connected properly, because if the tubing connected with the tank is attached to the short glass tube, when the oxygen is set free it will blow the cork and water out of the bottle.

To give the oxygen, place the tank by the bedside, the bottle on the table; open the valve on the tank sufficiently to allow the oxygen to form *small* bubbles in the water; hold the funnel either at the side of the

patient's face, tilted slightly forward, or at least twelve inches above the mouth—never hold it directly above the mouth, or the exhaled breath will be thrown back.

Passing the oxygen through the water serves two purposes: (1) the gas probably becomes somewhat moistened, just as the air does in its passage through the pharynx, and (2) the amount of oxygen that is being used can be estimated and controlled. If sufficient oxygen is passing through the water to form large bubbles, the gas is being wasted.

The Giving of Medicine by Inunction

This method of giving medicine was described in Chapter XVI., page 417.

The Giving of Medicine by Rectum

The two most common ways of giving medicine by rectum are in enemata or suppositories.

The giving of enemata was described in Chapter XIII.

Suppositories.—These are cone-shaped preparations of cocoa butter with a drug incorporated. The cocoa butter, though hard enough to retain its consistency in the usual room temperature, melts readily after it is introduced into the rectum and releases the drug, which can then be absorbed. To insert a suppository, oil both it and your index finger and push the suppository as far into the rectum as you can; afterward, hold a folded towel against the rectum until all desire to expel the suppository has subsided.

Application of Medicine to the Eyes

To the Lids.—Medication is often applied to the lids by means of a small piece of sterile cotton wound

smoothly on an applicator and moistened in the solution or ointment. The lids are everted and the wet cotton rubbed gently over the exposed surface The methods of everting the lids were explained in Chapter XII., page 348.

Certain solid substances as alum, sulphate of copper, and mitigated silver nitrate are often applied to the lids. These preparations are obtained in the form of sticks or pencils and usually are mounted in holders which have caps to cover them when not in use. The stick is used in the same way as the moistened cotton; it should be dipped into sterile water before and after use.

Application of Medicine to the Eyeballs.—The usual method of dropping medicine—not intended for cleansing—into the eye is to pull down the lower lid and have the patient look up and then to drop the required number of drops into the outer corner of the trough thus formed. As soon as the drops are in, tell the patient to blink the lids and this will scatter the drops over the eye, at the same time you must press your finger over the opening into the tear sac, in the inner canthus, in order to prevent the drops getting into the nose. This is necessary for two reasons: (1) if the medication flows into the tear sac, the eye will not be as much benefited by it as it should be; (2) such drugs as atropin and cocain are sometimes applied to the eye in solutions that are strong enough to produce poisonous symptoms in children or susceptible adults, if they are absorbed, as they are likely to be if they pass through the tear sac and ducts into the nose.

Another very important point to remember when putting drops into the eye is that the dropper must not touch the eye.

CHAPTER XVIII

PREPARATION OF PATIENTS FOR GYNECOLOGICAL EXAMINATIONS AND TREATMENTS

Positions in which Patients are Placed for Gynecological Examinations, Treatments, and Operations. Methods of Draping Patients when in Such Positions. Preparation of Patients for Gynecological Examinations. Articles Required for Gynecological Examinations and Simple Treatments. How to Hold a Sims Speculum. Purposes of Tampons. Methods of Making and Removing Tampons. Purpose of Pessaries. Method of Disinfecting and Removing Pessaries.

GYNECOLOGY is the name given to the branch of medicine which deals with the treatment of abnormal conditions of the female organs of generation. The word is derived from two Greek words signifying a discourse of women.

Nurses must display consummate tact in dealing with patients undergoing such treatments, otherwise they may alarm the modesty or wound the sensibilities of a patient. The surest foundation for such tact is a knowledge of the principles of gynecology and deftness. Hence nurses should spare no pains to acquire both. It is especially important that nurses be familiar with the positions in which patients are placed for gynecological examinations, treatments, and operations. Those most frequently used are as follows:

The Dorsal, Horizontal, or Supine Position.—In this position, the patient lies flat on her back, with her legs either extended or else slightly drawn up so as to relax the abdominal muscles.

The Dorsal Recumbent Position.—In the dorsal recumbent position, the patient lies flat on her back with her knees drawn up and separated, her feet placed on the bed, or, if she is on the special table used for gynecological examinations, on the extensions provided for the feet. Frequently, when there is no table to be had, it is necessary to put the patient across the bed with her feet on two chairs and in such case it is better to place a piece of board under the part of the mattress on which the patient will lie. When the patient is on a table, or lying across the bed, her buttocks should come to the extreme edge, or even slightly beyond the edge, of the table or bed.

Dorsal Lithotomy Position.—The dorsal lithotomy position is the same as the dorsal recumbent, except that the thighs are flexed on the abdomen and the legs flexed at right angles with the thighs and held in position with a crutch or, when such cannot be obtained, by a folded sheet passed under the knees and fastened either around one shoulder or the back of the neck.

The Sims or Left Lateral Position.—In this position, the patient lies somewhat obliquely across the table or bed on her left side, with the left side of her face, her left shoulder, and her left breast resting upon a flat pillow or the table. Her left arm lies straight on the table behind her back; her right, loose at her side. Her thighs are well flexed upon her body, the right one more so than the left. The buttocks should come to the extreme edge of the table; one of

the table extensions is sometimes drawn out to support the patient's feet. If the patient remains in bed she must lie across it and a board must be under the mattress as for the dorsal recumbent position.

Knee-Chest Position.—In this position, the patient kneels, her knees slightly separated, her chest resting upon a pillow placed upon the same level as her knees; her head on the same pillow, turned on one side; her arms, flexed at the elbow, rest on the table and help to support her.

Standing or Erect Position.—In the standing position, the patient stands with her knees separated about ten inches, one foot on the floor, the other on a low stool and her hand on a table or other support.

Trendelenburg Position.—In the Trendelenberg position the patient lies on her back, her thighs elevated against an inclined plane and her legs, from the knees, resting against a support which slants downward. If the patient is under the influence of an anesthetic, while in this position, her legs must be tied to the support.

In hospitals, there is a specific table adjustment for this position; in a private house, an inverted chair, fastened to the end of a narrow table, is a good substitute.

Another position called the Trendelenberg is secured by placing the patient in the supine position with her shoulders resting against shoulder supports, and lowering the head of the table.

Methods of Draping a Patient so as to Prevent Exposure when in these Positions

For the Dorsal Positions.—Method I. Place a sheet with its length across the patient's body; gather

the lower edge up in the center so that the vulva, but the vulva only, is exposed; twist the two lower corners one around each foot—part of the sheet should then fall like curtains on either side of the legs. Place a towel on the abdomen with one end falling over the vulva.

Method II. Do this in the same way as Method I, except that you will retain the sheet in place by tucking the upper corners under the patient's buttocks and back instead of twisting the lower corners around the feet, these being allowed to hang loosely over the legs and feet.

Method III. This method requires a fenestrated sheet. Place the sheet corner-wise over the patient with the opening exposing the vulva; turn back the lower point and tuck it under the buttocks; twist the two side corners securely around the feet but allow the sheet to hang loosely on either side of the legs; bring the upper corner of the sheet well up over the abdomen, but turn back its upper portion so that its point will fall over and screen the vulva.

Arrangement of the Sheet for the Sims Position.—Method I. Cover the patient's body with a sheet, turn part of it behind the patient so that you will be able to tuck the two corners of the lower edge and the greater part of the lower edge between her legs and thighs, in this way an opening will be left over the vulva; place a towel on the body so that one end will fall over the vulva.

Method II. Place a fenestrated sheet corner-wise over the patient with the opening over the vulva. To keep the sheet in place, tuck one of the side corners under the patient's back and buttocks, the lower one under her legs; bring the upper corner well up over the

patient, but turn back its point so that it will screen the vulva.

Arrangement of Sheet with the Patient in the Knee-Chest Position.—Method I. Cover the patient with a sheet, gather up the lower part in the center and, in order to retain it in place, pin it to the patient's wrapper. Also pin the two sides of the lower edge of the sheet together over the thighs and legs. Place a towel so that one end will fall over the vulva.

Method II. Place a fenestrated sheet over the patient with the opening exposing the vulva; pin the sheet to the patient's wrapper and, if necessary, to the table pad. Place a towel so that it will fall over the vulva.

N. B. For all these methods allow the sheet to hang as loosely as is consistent with its being retained in place. The things desired are: to have the sheet tucked in securely where it is necessary for it to be so, but to avoid all outline of the patient's figure; to have the sheet arranged around the vulva so that it will not be in the physician's way, but that there will be no unnecessary exposure.

Method of Arranging Sheet with the Patient Standing.—Pin a sheet around the patient's waist, allowing it to fall around her legs like a skirt with the opening at one side.

Preparation of Patient for Examination.—When the patient is in the hospital, if her bowels have not moved within twenty-four hours, an enema is generally given. Sometimes a vaginal douche is given, but this is not always the case, and a douche is rarely given before a first examination, for the physician usually wishes to see the character of the discharge, if there is any, and the general condition of the

vagina, before any changes are made in it by the douche. Especially with a dispensary patient, it is important to notice, while placing her in position, if the skin and mucous membrane covering the parts to be exposed are clean, and if not, to make them so.

The patient's clothing, if she is in the hospital and is moved from her bed, usually consists of a nightgown and wrapper, and the long stockings very generally known as *laparotomy stockings.* In the home and sometimes in the hospital, ordinary stockings, slippers, and open drawers are worn instead of the laparotomy stockings. When the patient remains in bed, the wrapper is sometimes omitted and the upper part of her body is covered with a blanket or folded sheet. When the patient is put on the table, her wrapper and nightgown are doubled up smoothly under her back. They must be drawn well up beyond the edge of the table so that they will not be soiled by any lubricant or lotion that may be used. The clothes must come above the pubes in front and must be quite loose so that they can be quickly gathered up in the center if the physician wishes to see the abdomen.

If the patient is dressed, as is usually the case in dispensaries, her corsets and all waist bands must be unfastened, and her skirts folded up in the same way as the nightgown and wrapper.

Articles Required for a Gynecological Examination.—Sometimes gynecologists require special articles and instruments for an examination, but those nearly always needed are a rubber glove, an emulsion of white soap or other lubricant, either a bivalve, Sims, or other variety of speculum, and a uterine sound. If a local application is to be made, usually there will be needed, in addition to the articles already

mentioned, uterine and dressing forceps, an applicator, a sponge holder, scissors, tampons or gauze packing, sponges, and the required disinfectant or lotion. All these articles should be sterile.

How to Hold the Sims Speculum.—When the patient is in the Sims position, the Sims speculum is often used and has to be held by the nurse. To do this, stand on the left side of the patient, resting your left arm lightly on her hip, separating the buttocks with your left hand. After the doctor has inserted the speculum, grasp its handle with your right hand and hold it so that your thumb and fingers are on the inner side—*i. e.*, next the patient.

Tampons.—Tampons are much used in gynecological work for they serve a number of purposes—*e.* g., they are used to apply medication to the vaginal walls and the cervix, to keep apart and to protect inflamed or ulcerated surfaces, to support a prolapsed ovary, to distend the vagina and thereby stretch adhesions and hold the uterus in position.

Tampons are usually left in place for twenty-four hours. The nurse assisting the doctor should mark the number inserted, and if she is not sure, ask the doctor, for the number must be recorded on the patient's chart, so that whoever removes them will be sure that they are all taken out. If the patient is to remove them herself, she must be told the number. They are removed by making traction on the strings with which they are tied.

Tampons are usually made of either absorbent cotton or lamb's wool. They are made in a variety of ways. One method of making cotton tampons is as follows: Cut a strip of absorbent cotton one inch thick, three inches wide, and six inches long; roll this strip,

and tie it in the center with strong linen or silk thread; leave strings of the thread about six inches long and form them into a loop by knotting their ends. Another method is to cut a strip of cotton as for Method I, but to place the string, which should be about fourteen inches long, across one end, as shown in Fig. 33, leaving an equal length of string projecting from each side of the cotton roll; tie the two ends of

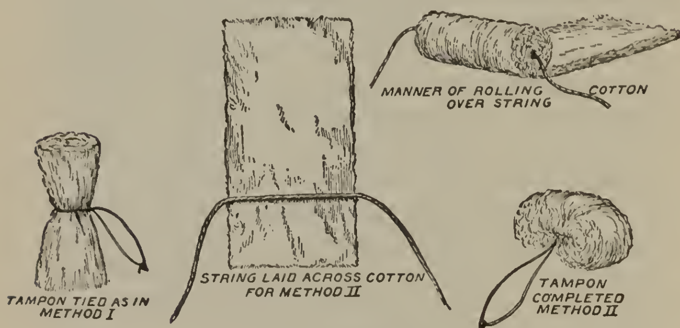


Fig. 33. Tampons

the string together; this will bring the ends of the roll together also. The ends of the string are knotted as in Method I. A common method of making lamb's wool tampons is: Cut a strip of wool about ten inches long and two inches wide; turn this around your fingers; pass a piece of linen thread through the ring thus made and tie it; leave the strings about six inches long and knot them together at their ends. They are also made in the same way as the cotton tampons.

PESSARIES.—Pessaries are used to correct uterine displacements. They are made in a variety of shapes, usually of hard rubber. They cannot be boiled, for

heat softens the rubber, therefore, they are disinfected before and after use by immersion in a disinfectant solution—bichlorid 1:500 is frequently used—and, before being inserted, they are dipped in sterile water.

Occasionally a nurse is told to remove a pessary. To do so, wash and disinfect your hands, introduce the index and middle fingers of your right hand into the vagina, bend the index finger over the anterior bar of the pessary, give the pessary a slight turn and pull it down gently.

The more common gynecological diseases and the special points to be considered in nursing patients suffering with such diseases will be discussed in Chapters XX and XXV.

CHAPTER XIX

BANDAGES, STRAPPING, AND SPLINTS

Use, Nature, and Sizes of Bandages. How to Make Bandages. Points to Remember in Bandaging. How to Make and Apply Plaster Bandages. Circular, Spiral, Spiral Reverse, Recurrent, and Figure-Eight Bandages. Bandages for the Leg, Foot, Heel, Knee, Arm, Hand, Fingers. Spica for Shoulder and Thigh. Bandages for the Head, Eyes, Jaw, and Breasts. Velpeau Bandage. Tailed Bandages. Binders and Slings. Handkerchief Bandages. Strapping of Chest, Knee, and Ankle. Splints. Buck's Extension. Vertical Extension.

Bandages

USES OF BANDAGES.—Bandages are used to keep applications and surgical dressings in place, to make compression, to control the circulation, to reduce swelling, to limit motion, and to afford support.

MATERIAL USED FOR BANDAGES. PURPOSE OF EACH KIND OF BANDAGE.—Bandages are most commonly made of either gauze, crinoline, muslin, flannel, Canton flannel, or rubber. Also, bandages made of loose meshed materials can be bought. These are not much used in the hospitals as they are comparatively expensive—30 to 60 cents a bandage—but, as they can be washed, are very easily put on, and uniform pressure can be more easily secured with them than with other bandages, they are very useful for home use and frequently can be used in place of a rubber bandage. Gauze is usually preferred for

keeping dressings in place because it is lighter, cooler, and more easily adjusted than the other materials. Crinoline, which is generally stiffened with plaster of Paris, is used to give support and prevent motion. Flannel and Canton flannel are sometimes used under plaster bandages and splints to protect the skin. Flannel bandages are also used to reduce swelling and edema, and when used for this purpose they are cut on the bias. Rubber bandages are used to afford support, as in weak ankles and varicose veins, and to control hemorrhage. Muslin is used to keep splints in position and as a substitute for other material.

Size of Bandages.—The average width and length of bandages are: one inch wide, three yards long for finger bandages; two to three inches wide, six yards long for those for the head and extremities; four to six inches wide, eight yards long for the trunk.

Names of Different Parts of a Bandage.—The different parts of the bandage are known as the roll, the initial and the terminal end, the outer surface and the inner surface. When each end is wound toward the middle, forming two rolls, the bandage is called a double roller.

Making Bandages.—Bandages must be smoothly and tightly rolled and all ravelings removed. There are various machines for rolling bandages. On some, the whole width of the material is rolled at once, the bandages being cut the required width afterward. For others, the material is cut or torn into the required width before rolling. But whatever the machine used, never fail to hold the free end of the material firmly in order that the bandage may be rolled tightly and without wrinkles.

To Tear Bandage Material.—Obtain a piece

of material the length that the bandages are to be. Along one end of this measure, with a foot rule or tape measure, the required width for each bandage, marking the place with a slit, then tear the material at each slit, a few inches. Next take hold of every other strand thus made and have an assistant take the alternate strands, each pull in opposite directions until you have torn through the length of the material. Remove the ravelings and arrange the strips so that they can be rolled easily.

To Make a Bandage by Hand.—Tear or cut the material the required width, remove the selvage and ravelings. Fold one end of the strip several times upon itself until a small, but stiff, roll is formed. Then hold the free end of the strip very tightly between the index and middle fingers of the left hand, grasp the roll at each end between the thumb and forefinger of the right hand, and rotate the roll until the bandage is completed.

To Make Plaster of Paris Bandages.—Choose fresh plaster of good quality and without lumps. Cut fine crinoline into strips the required length and width and spread and rub the plaster evenly into the meshes of the crinoline with a knife, spatula, or tightly-rolled bandage unless there is a regular machine for applying it. Roll the strip loosely as each portion is finished. Store in an air-tight tin box. Wide plaster bandages should be rolled on sticks, since this prevents them doubling when wet.

Points to Remember in Bandaging.—Bandages must be put on tightly enough to insure their remaining in place. As a rule, except when there is inflammation, or a wound, the bandage should make a certain amount of pressure, but it must never be tight enough

to cause pain or impede the circulation, and the pressure must be even. That it may be so, no one turn of the bandage must be tighter than another and each turn must overlap the other an equal distance. In bandaging an extremity the toes or fingers are usually left uncovered as thus it can be easily seen whether the bandage is too tight. If the toes or fingers become cyanosed the bandage should be removed or the surgeon notified.

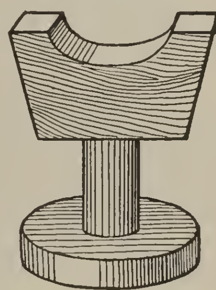


Fig. 34. Heel Rest

Before bandaging a joint that is to be immobilized, always place the extremity involved in the position in which it will remain afterward. When bandaging the leg, always support it. For this purpose a sand-bag is a good substitute for the regular heel rest. When putting on a spica of the groin, place a pillow, or two or three sand-bags, under the upper portion of the back, so that the part under which the bandage has to pass back and forth will be raised from the bed. Hold the bandage roll side upward, begin to bandage at the distal end of the part to be covered, and work from the extremity toward the trunk and from right to left. Always pin or tie the bandage so that the knot or pin will not come in contact with any part of the patient's body, or be where he will lie upon it. Always use safety-pins for pinning. To tie a bandage, tear a few inches of the material, twist the two ends around each other, and pass one end in one direction around the extremity and the other in the other direction, and tie over the twist.

To Apply Plaster Bandages.—The requisites for applying plaster bandages will be:

1. Two large rubber sheets, one to protect the floor and the other the bed.

2. A doctor's apron.

3. Two or three sand-bags.

4. Muslin, soft flannel, or thin Canton flannel bandages.

5. Two strips of Canton flannel three inches wide, cut on the bias, long enough to go around the leg at both ends of the cast. These are called "cuffs."

6. Plaster bandages.

7. A basin containing sufficient warm water to cover three or four bandages at a time. Salt, one dram to one quart, is generally added to the water, as it hastens the drying of the plaster.

To prepare the limb, shave it, wash it with soap and water, dry it well, and powder it.

A few minutes before the doctor is ready for the plaster bandages, put two or three of them in the water. When the bubbles cease to rise, they are thoroughly soaked and ready for use. Put more in as required. One should be always ready when needed. Squeeze the bandage gently to remove the surplus water, and pull off any ravelings before handing the bandage to the doctor. While squeezing the bandage surround its two ends with the hands, for this helps to prevent the escape of the plaster.

When required to hold a leg during the application of a cast keep it in the exact position in which it is placed.

Either a soft muslin or thin Canton flannel bandage is put on under the plaster bandage to protect the skin from the rough plaster, and a "cuff" of

Canton flannel is secured at either end of the cast. These "cuffs" are put around the leg and held in place by the first layer of plaster bandage. Three or four layers of plaster bandage are applied, according to the desired strength of the cast, and the upper edge of the "cuff" is turned over and secured in place by the last layer. After the bandage is completed, some of the plaster in the bottom of the basin is rubbed over the surface of the cast. Plaster bandages are never put on as tightly as other bandages because the material shrinks as it dries.

Leave the protecting rubber sheet on the bed until the cast is dry. Place sand-bags on either side of the extremity to keep it from moving and so breaking the cast. Leave the cast uncovered until it is dry. Never empty the plaster remaining in the basin into the hopper or closet, since it will harden and block the pipes.

To Remove a Plaster Bandage.—To remove a plaster bandage, moisten it in a straight line down the front (or wherever the opening is desired) with some such liquid as bichloride of mercury, dilute hydrochloric acid, vinegar, or peroxide of hydrogen, and then cut it with a plaster knife or a strong pair of scissors.

Methods of Bandaging. The Fundamental Bandages.—The fundamental bandages, on which the construction of the greater number of the special bandages is based, are the circular, the spiral, the spiral reversed, the figure-eight, and the recurrent.

The Circular Bandage.—The circular bandage consists of two or three circular turns, each turn covering the preceding one.

The Spiral Bandage.—The spiral bandage can be applied only to parts of uniform circumference.

It consists of circular oblique turns, each one made higher than the preceding one, but overlapping it about one-half its width.

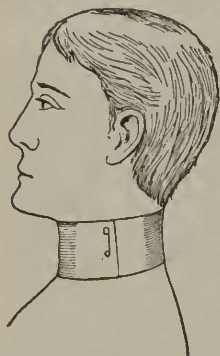


Fig. 35. Circular Bandage

The Spiral Reverse.—The spiral reverse bandage consists of an ordinary spiral bandage with reverses. To make the reverse, place the thumb of the left hand at the point where the reverse is to be made, pronate the right hand, in which the roll is held, thus doubling the bandage upon itself (see engraving), and

Fig. 36. Spiral Bandage

Fig. 38. Forearm with Simple Spiral below and the Reverse above

Fig. 37. Spiral Reverse

make traction on the bandage with the right hand to draw it well into place. Make each reverse directly above the preceding one. By thus reversing the bandage, the turns can be adjusted to the contours of the body.

The reverse is used principally for the legs and arms.

THE FIGURE-EIGHT BANDAGE.—The figure-eight bandage consists of a series of oblique turns alter-

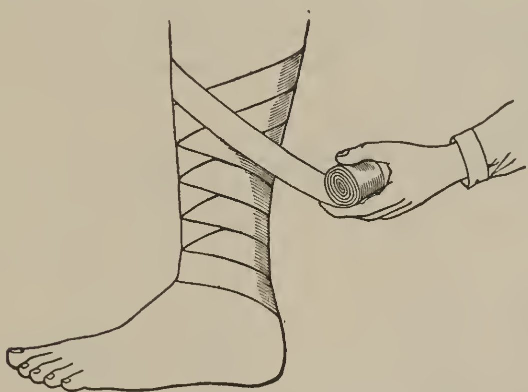


Fig. 39. Figure-Eight Bandage

nately ascending and descending and crossing each other in such a manner that they form the figure-eight. The figure-eight is sometimes used instead of the reverse for the extremities; it is often used for the hands and feet; it is the foundation of the spicas and many other special bandages; and it is particularly valuable to retain dressings in place and to give support to the elbow and knee joints.

When bandaging a leg, it is well, after making the first two or three turns—either reverse or figure-eight—to carry the bandage up and around the leg

above the calf, then down around the leg to the top of the regular turns and, afterward, to continue as at first. The turn above the calf tends to prevent the bandage slipping.

The Recurrent Bandage.—The recurrent bandage consists of a series of turns passed back and forth across the part to be bandaged, each turn overlapping the other one half its width. The ends are secured by a circular turn around them. The recurrent bandage is principally used to retain dressings in place on the ends of the fingers, toes, stumps, and the head.

Bandage of the Foot.—Take a circular turn around the ankle, carry the roll over the dorsum of the foot, then under the toes and back over the dorsum of the foot, crossing the first turn in the middle line of the foot, pass upward and back of the ankle, then down again over and under the foot as before. Continue the turns until the foot is covered, making each one higher on the foot and ankle than the preceding turn and covering the latter one half its width.

Fig. 40. Bandage of the Foot

Bandage of the Heel.—Use a three-inch bandage; take a couple of turns around the heel, having the point of the heel in the center of the bandage, then carry the roll around the ankle, covering the upper part of the turns around the heel for at least one inch,

pass obliquely over the dorsum of the foot, under the heel, covering half the turn that is around it, back over the foot, crossing the downward turn in the middle of the foot, around the ankle and down, over and under the foot as before. Repeat the turns as often as necessary, making each turn lower on the foot and higher on the ankle than the preceding turn.

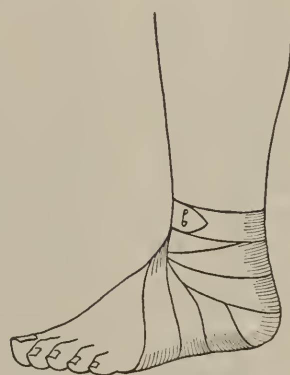


Fig. 41. Bandage of the Heel

Spica of the Shoulder.—To apply a spica of the shoulder: Fix the initial extremity by a couple of circular turns around the middle of the arm, make a few spiral reverse or figure-eight turns around the arm, then carry the bandage across the chest, if it is the right side that is injured, or across the back, if it is the left side that is injured; continue the turn

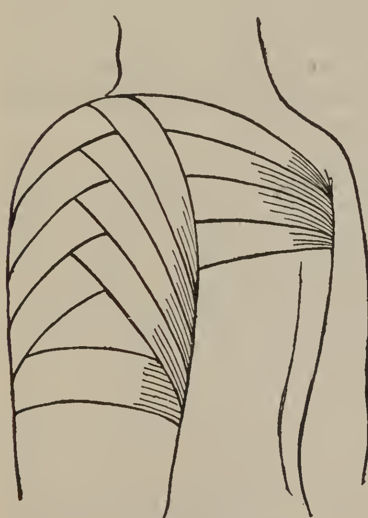


Fig. 42. Spica of the Shoulder

around the body, passing under the armpit of the uninjured arm, to the injured arm, pass the bandage around this arm, and then carry it across the chest or back again. Continue to make these turns until the arm and shoulder are covered. Cover the turns around the arm and shoulder one half their width, but converge the bandage as it crosses the chest so that the fold under the armpit will be narrowed.

Spica of the Thigh.—Take a circular turn around the thigh to fix the bandage in place, then take a few reverse or figure-eight turns. Next, carry the bandage forward from the outer side of the thigh across the groin and obliquely over the pubes to above the crest of the ilium on the opposite side. Continue around the back, down over the ilium of the bandaged thigh to the inner side of the latter, pass around the thigh to the outer side, then carry the bandage forward and continue as before. Each turn should be higher than the preceding turn and overlap it two thirds its width except in passing over the ilium above the unbandaged thigh where the turns converge.

Bandage for the Hand and Forearm.—To put a bandage on the hand and forearm when it is necessary to cover each finger separately: Begin at the tip of the first finger. Cover it, either by a succession of circular turns or figures of eight, to its base. Then take a turn around the wrist to keep these from slipping and return to the root of the second finger. Lead the bandage by one or two spiral turns to the tip, then proceed down it, as on the first finger, and conclude with another turn around the wrist. Cover each finger successively in the same way. Next take a wider bandage and make two circular turns around the base of the fingers. On reaching the center of the

back of the hand for the second time pass the bandage obliquely across it, around the wrist, up across the back of the hand, crossing the other oblique turn in the median line, around the palm and down again across the back of the hand, making the turn lower on the hand but overlapping the former one half its width. Repeat these turns until the hand is covered. Finish with a circular turn, or proceed up the forearm using either reverse or figure-eight turns.

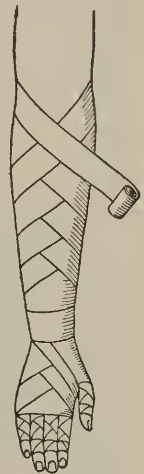


Fig. 43. For Hand and Forearm

When it is not necessary to cover each finger separately: Put gauze or cotton between and over the tops of the fingers. Place the initial end of the bandage well down on the palm of the hand. Take recurrent turns back and forth across the tops of the fingers, covering each preceding turn one half its width. Hold these turns in place with the thumb and first finger of the left hand, secure them with a couple of circular turns around the hand, and then proceed up the hand as already directed. If it is necessary to cover the thumb, do it first. Then take a circular turn around the hand, hold the bandage in place with the left hand, and start the recurrent turns over the fingers.

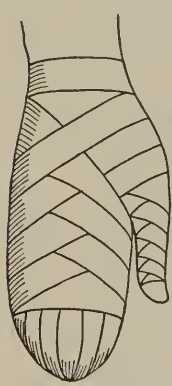


Fig. 44. For the Hand

Elbow Bandage.—Large joints such as the elbow and knee should not be involved in the bandaging of the extremities unless it is necessary. When it is necessary to cover the elbow and upper arm, proceed as follows: Continue the reverses or figure-eight turns until within two inches of the elbow. Flex the forearm. Carry up the bandage directly over the elbow, having the point of the olecranon in the middle of the bandage. Bring the bandage down inside the joint to the forearm, keeping the upper edge of the bandage just below the point of the olecranon. Cross it on the inside of the joint and pass it above and around the elbow, having the lower edge of the bandage just above the point of the olecranon. Repeat the turns, making those on the forearm lower and those on the arm higher than the first ones and covering them one half their width in the back but converging in the front. Make one circular turn around the arm and proceed up it with either the reverse, spiral, or figure-eight turns.

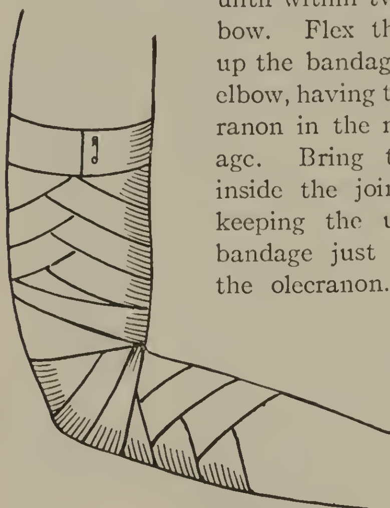


Fig. 45. Elbow Bandage

The knee is bandaged in the same manner as the elbow.

The Recurrent Bandage of the Head.—To apply a recurrent bandage to the head: Fix the bandage

by making two horizontal turns around the head. When the second turn comes to the center of the forehead have the patient or an assistant hold it in place. Reverse the bandage and carry it across the head, then reverse again, hold the bandage at this point in place with the thumb of the left hand, carry the roll across the head, overlapping the first row two thirds its width, converging toward the center, near the forehead. Repeat this turn on the opposite side of the first turn across the head. Rcpeat, carrying the bandage back and forth, first on one side and then on the other, until the head is covered. Finish with a couple of circular turns around the head.

Fig. 46. Recurrent Bandage

Fig. 47. Recurrent Bandage with Double Roller

The Capeline or Recurrent Bandage of the Head with Double Roller.—For a capeline bandage use a double roller, or if there is no double roller at hand two bandages with their free ends sewed—nevcr pinned—together. To apply it: Place the center of the bandage in the center of the forehead, carry both cylinders to the occiput from opposite sides, reverse

one end of the bandage, turning it over the other, which continue horizontally around the head to the forehead, bring the reversed end obliquely around the head, cross it with the horizontal end, reverse it over this, and carry it around the other side of the head. Repeat these turns, making every turn of the oblique bandage higher than the other, but overlapping it two thirds its width. Make each horizontal turn exactly cover the preceding one.

Fig. 48. Bandage for Front of Scalp


Fig. 49. Bandage for Side of Head

Bandage for Front of Scalp.—To apply a bandage to the front of the scalp: Place the initial extremity of the bandage on one temple and fix it by two circular turns. Carry the bandage downward, around the occiput, and upward, over the brow, covering the circular turn one half its width. Continue obliquely downward around the nape of the neck, then up, crossing just above the ear over the front of the head, and down again on the other side.

Bandage for the Side of the Head.—To apply a bandage to the side of the head: Fix the bandage

with a couple of circular turns. On reaching the forehead the second time secure the bandage with a small pin. Reverse, carrying the bandage around the head to the nape of the neck, overlapping the circular turn half its width. Reverse, hold the bandage in place, and carry it back to the forehead still higher up on the side. Repeat the turns and complete with a circular turn.

Figure-Eight Bandage for One Eye.—To put this style of bandage on the right eye, place the free end of the bandage in the center of the forehead, carry the bandage toward the left side of the patient's head and, make one complete turn around the head just above the ears; then continue the bandage round the head, on a little lower level, carry it under the occiput, under the right ear, up over the right eye to the forehead; then take a second turn of the bandage around the head directly over the first one; next, take a second diagonal turn, making it one half inch higher on the side of the head above the ear on the left side, slant it down under the occiput, bring it forward under the right ear and up over the right eye—one half inch lower than the first turn—to

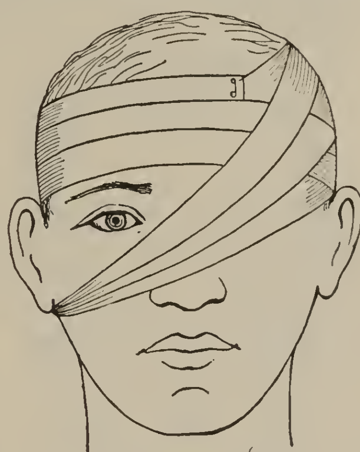


Fig. 50. Figure-Eight Bandage for One Eye

the forehead. Make a third circular turn and then a third diagonal one, having the latter one half inch higher on the left side of the head and one half inch lower over the right eye than the former turn. Finish with a circular turn. Have the bandage at very slight tension when making the diagonal turns, for there must be no pressure over the eye.

Bandage the left eye in the same way as the right, but reverse the direction of the circular turns.

Figure-Eight Bandage for Both Eyes.—Make two circular turns around the head, carry the bandage down over the eye—say the left,—under the ear, back of the occiput, under the right ear, up over the right eye, around the head and forehead—above the ears,—down over the left eye, under the left ear, around the occiput, under the right ear, and then up over the right eye and around the head and forehead as before. Repeat the turns as often as necessary. Finish with a circular turn. As for the single-eye bandage, the turn around the head must be sufficiently tight to hold the bandage in place, but there must be no pressure over the eyes.

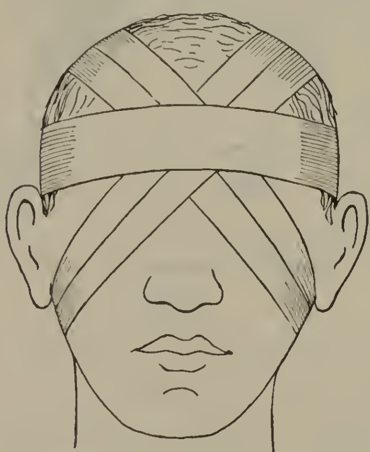


Fig. 51. Figure-Eight Bandage for Both Eyes

Bandage for the Jaw.—Place the initial end of the bandage on top of the head, hold it in place with the thumb of the left hand, carry the roll around the face in front of the ears and under the chin. Upon reaching the starting-point pass over it and carry the bandage back of one ear, around the back of the neck, over the chin, around back of the neck, and up around the back of the head to the starting-point, and then around the face and chin as before, and so on. Repeat these turns two or three times, covering each one exactly. Finish with the turn which crosses under the chin. Pin on the top of the head.

Fig. 52. Bandage for the Jaw

Fig. 53. Suspensory Bandage for the Breast

Suspensory Bandage for the Breast.—To apply a suspensory bandage to the breast: Place the initial extremity of the bandage on the left side of the chest, carrying it from left to right. Make two circular turns. On reaching the left breast, incline the bandage upward across the lower portion of the breast, over the opposite shoulder, down the back, around the body, and up again

over the breast and shoulder, as in the first turn, overlapping it one half its width. Repeat as often as necessary. The turns should overlap each other, forming the figure-eight under the most pendent part of the left breast.

Figure of Eight Bandage for Both Breasts.—Turn 1. Place the initial end of the bandage upon the right scapula and carry it over the opposite shoulder, across the chest, under the right breast, around the back and forward until the left breast is reached, then under that and obliquely across the chest over the right shoulder and across the back. Turn 2. Make a circular turn around the chest taking in the lower border of both breasts. Alternate these two turns, until the breasts are covered, each time overlapping a previous turn two thirds of its width.

Fig. 54. Bandage for Both Breasts

Velpeau Bandage. — Before starting to apply a Velpeau bandage, place the hand of the injured side upon the sound shoulder, bringing the elbow almost below the point of the sternum, powder the skin

between the arm and body, apply a thin layer of cotton, and place a pad in the axilla, and one over the seat of fracture. To apply a Velpeau bandage: Put the initial end of the bandage under the injured arm, secure it in place by making a circular turn around the chest; then carry the bandage on to the uninjured side and obliquely across the back, over the shoulder of the injured arm, down the front of the arm, under the elbow, up the back of the arm around the shoulder — this will give a figure-eight on the shoulder,—across the front of the chest, passing over the forearm, then around, first the back, and then the front of the chest, passing over the elbow of the injured arm and around the chest to the back, up across the back obliquely, and over the shoulder of the injured arm as before. Repeat the turns as often as necessary. Each turn down the front of the arm is to be farther toward the median line and to cover the preceding turn about three quarters of its width; each turn up the back of the arm is to be farther toward the back; each turn crossing the front of the chest is to be higher on the forearm or wrist; each of the turns going around the body is to be higher than the preceding turn and to cover one half its width.

Fig. 55. Velpeau Bandage

Tailed Bandages and Slings.—Tailed bandages are very convenient for keeping poultices and other applications in place.

Fig. 56. Four-Tailed Bandage of the Head

The Four-Tailed Bandage of the Head. — To apply a four-tailed bandage to the head: Take a piece of muslin eight inches wide and long enough to go over the head and tie under the chin. Cut it in the middle from each extremity to within four or five inches of the center. Place the body of the bandage on the top of the head and tie the two posterior tails under the chin and the two anterior tails at the back of the neck.

If it is desired to cover the back of the head, place the body of the bandage there and fasten the two posterior tails around the forehead and the two anterior tails under the jaw.

Fig. 57. Tail Bandage on Back of Head

When the forehead is to be covered, place the body of the bandage there and fasten the two anterior tails at the back of the head and the two posterior tails under the chin.

Tail Bandage of the Chin.—To apply a tail bandage to the chin: Take a piece of muslin four

inches wide and about thirty-six inches long and cut it in thc middle to within three inches of the center.

Fig. 58. Tail Bandage on Forehead

Fig. 59. Tail Bandage for Chin

Place the body of the bandage on the chin. Tie the upper tails at the back of the nceck and the lower tails on top of the head. Then tie the four tails together on the top of the head.

The Four-Tailed Bandage of the Knee.—To apply a four-tailed bandage to the knec: Take a piece of muslin one and one quarter yards long and one quarter of a yard wide and split it in the middlc to within three inches of the ccnter. Placc the body of the bandage over the knee. Carry thc tails under the knee, cross them so that the upper ones will come below the joint and the

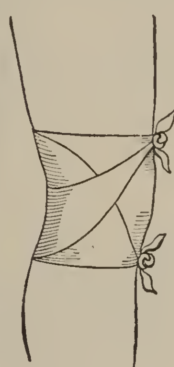


Fig. 60. Four-Tail Knee Bandage

lower ones above, bring them around, and tie them in front.

A Scultetus or Many-Tailed Binder for the Abdomen.—A scultetus or many-tailed binder is used

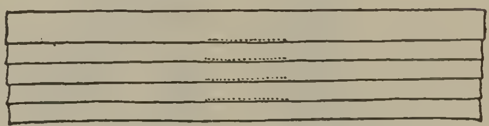


Fig. 61. Scultetus Binder

on the abdomen to obtain pressure or to keep applications and surgical dressings in place. To make it,

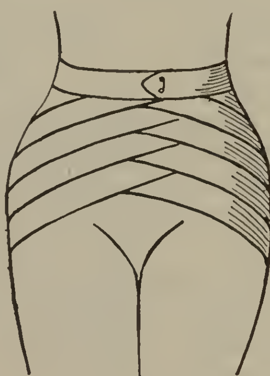


Fig. 62. Scultetus Applied

take four or five strips of muslin three inches wide and a yard and a quarter to a yard and a half long, place them each one overlapping the other half its width, and sew the edges down in the center for a quarter of a yard. To apply, pass half the bandage under the patient in such a way that the sewed part will come

under the back, and fold the strips, alternating from either side, obliquely over the abdomen, crossing them

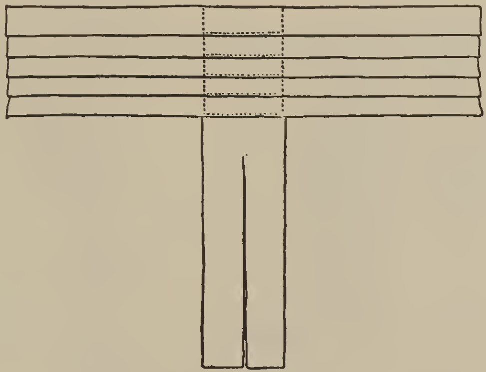


Fig. 63. Scultetus Binder with Tails

in the center. To prevent the binder from slipping up, two tails (see Fig. 63) are sometimes sewed to the lower edge of the binder. These tails are brought up between the legs and pinned in front.

T-BANDAGES.—T-bandages, as the name implies, are cut in the shape of the letter T. They are generally made of unbleached muslin. If the muslin is doubled and stitched around the edges, the bandages can be laundered and used for a long time.

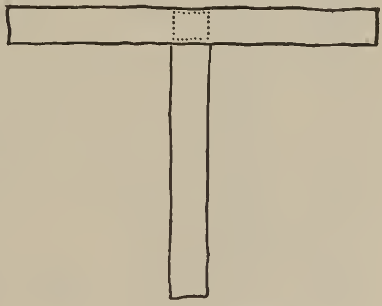


Fig. 64. T-Binder

T-binders are used to keep dressings over the rectum or external genitals in place. To put one on, put the horizontal band around the waist, bring the other one up between the thighs, and fasten the two with a safety pin.

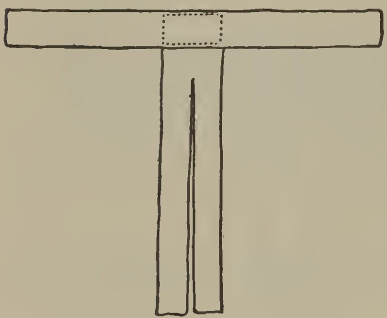


Fig. 65. Double T-Binder

Double T-Binder.—For male patients what is known as a *double T-binder* is used. This is the same as the other, except that the perpendicular band is wider and is split up the center to within about two inches of its attachment to the band that is intended to go around the waist.

Double T-Bandage of the Chest.—To make a double T-binder for the chest: Take a piece of material about eight inches wide and long enough to go around the chest and sew to its upper edge, near the center, about six inches apart, two strips, each

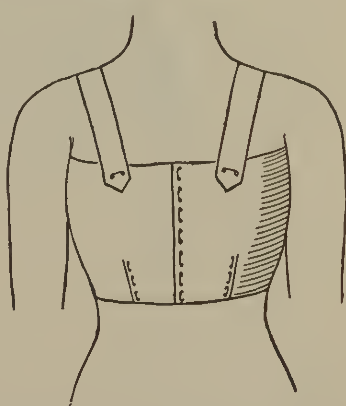


Fig. 66. Double T-Bandage for the Chest

of which is two inches wide and fourteen long. To apply, pin the binder in the front, bring the straps

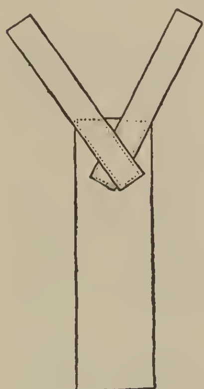


Fig. 67. (1) *Y-Binder*

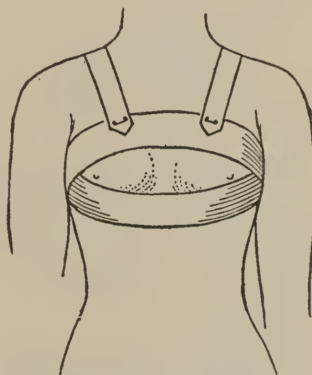


Fig. 68. (2) *Y-Binder*

over the shoulder and pin them in front. If necessary, pin a dart in under both breasts.

Y-Binder for the Breasts.—For a binder in the shape of a Y for the breasts the tail should be eight inches wide, and long enough to reach across the back and meet the two arms which cross the chest; the arms should be four inches wide. Put one of these arms under, and the other above, the breasts and pin them to the tail. Shoulder straps can be added if necessary.

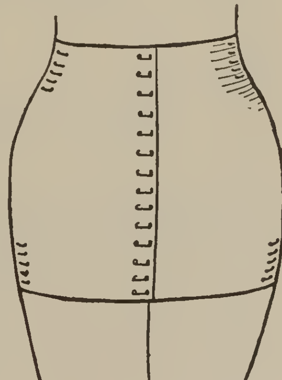


Fig. 69. Straight Binder for Abdomen

Straight Binders.—Are generally made of a double fold of unbleached muslin stitched together around the edges.

Straight Binder for the Abdomen.—Straight binders for the abdomen are sometimes used for obstetrical patients, after confinement. They should be about twelve to fourteen inches wide and long enough to go around the patient's body.

To apply, pin down the center with small safety-pins and pin darts on both sides, above and below the hip prominence. The lower darts are loosened when it is necessary for the patient to use the bed-pan.

Straight Binder for the Chest.—To make a straight binder for the chest, cut from a straight piece of

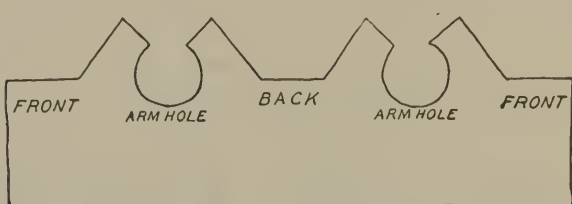


Fig. 70. Straight Binder for the Chest

muslin a section long enough to go around the body and wide enough to extend from the neck to the waist and shape it to fit around the arms and neck. To apply, pin it tightly down the front and over the shoulders, with small safety-pins, and adjust it to the body by pinning darts under both breasts. These binders are used to make pressure on the breasts, and to keep poultices and other applications in place. When using the binder for the former purpose, pad the

axillæ and between and around the breasts with non-absorbent cotton and fasten the binder as tightly as possible. When using the binder to keep poultices, etc., in place, it need not be put on as tightly and the darts are unnecessary.

Fig. 71. Straight Binder for Chest

SLINGS.—To make a sling, cut a square yard of muslin across diagonally. This will make two slings.

When the forearm is injured its whole extent should be supported squarely, and the sling is used for this purpose. To apply: Put the forearm in the center of the sling. Carry the outer end of the sling over the arm and tie it, at the back of the neck or on the shoulder, to the

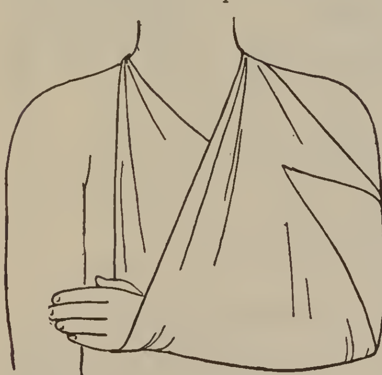


Fig. 72. Sling

inner end, after drawing this up between the arm and the chest. Bring the third point around the elbow and fasten it in front with a safety-pin.

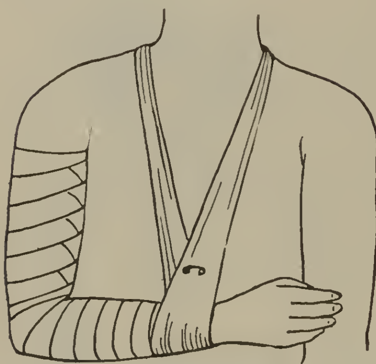


Fig. 73. Sling

When the upper arm is injured the wrist only should be supported. In this case, to apply the sling, proceed as follows: Turn the hand palm upward. Fold the sling. Place the wrist in the center of the folded sling, cross and knot or pin its ends a few inches above the wrist, and then tie them around the neck.

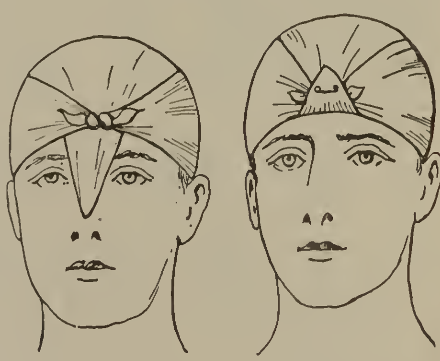


Fig. 74 *Fig. 75*

Handkerchief Bandage

Handkerchief Bandages. *Handkerchief Bandage for the Head.*—To apply a handkerchief bandage to the head: Fold it so that it has three corners. Place the base of this triangle on the nape

of the neck and the apex over the forehead, allowing it to hang down in front (as in Fig. 74). Knot the other two ends in front, turn the apex up over the knot and pin it.

Handkerchief Bandage for the Hand.—To put a handkerchief bandage on the hand: Fold it as for the head, place the base of the triangle at the front of the wrist, carry the apex up over the fingers, and fold the two extremities, one on either side, around the hand. Cross the ends, bring them around the wrist, and tie them. Pin the apex in place unless it comes far enough up on the wrist to be secured by the points.

Fig. 76
Handkerchief Bandage

Handkerchief Bandage for Foot.—To put a handkerchief bandage on the foot: Place the base of the triangle above the heel and bring the apex up over the toes to the front of the ankle joint.

Fig. 77. Handkerchief Bandage for the Foot

Fold the two extremities down one on either side over the instep, around under the sole of the foot, and back again to the instep.

Handkerchief Bandage of the Heel.—To put a handkerchief bandage to the heel: Place the base of the triangle on the sole of the foot beneath the instep and the apex at the back of the leg. Bring the two extremities up over the instep and round to the back of the leg. Cross, and bring them once more round the leg and tie in front.

Fig. 78. Handkerchief Bandage for the Heel

Strapping

Adhesive strapping is largely employed to insure the immobilization of parts (as in strapping of the chest for fractured ribs and pleurisy) and to give support and uniform pressure (as in injury to, or disease of, the knee, ankle, or other joints). Before applying adhesive straps, wash and shave the part which is to be strapped.

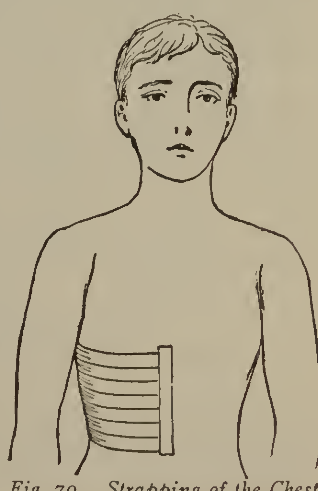


Fig. 79. Strapping of the Chest

Strapping the Chest.—The chest is strapped for fracture of the ribs in order that the bones by being kept immobile may have a better

chance to unite. It is strapped in pleurisy to give relief from pain by restricting the depth of the respirations.

To strap the chest: Take either a piece of adhesive plaster long enough to extend from the far side of the spine to the sternum and wide enough to cover from just below the breast to below the margin of the ribs, or several pieces of adhesive plaster about two inches wide stuck together, overlapping each other half their width. Prepare the chest by shaving and powdering. Place one end of the strapping on the spine. Make the patient take a deep breath and then "let out his breath," and, while the lungs are thus comparatively empty, quickly stretch the plaster and fix its free end over the far end of the sternum. Mold it to the body with the palm of the hand until all wrinkles are removed. To prevent the ends of the plaster from curling put a narrow strip of adhesive plaster down both the back and the front.

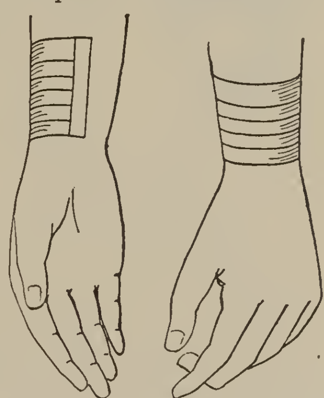


Fig. 80. Strapping of the Wrist

Another way of strapping is to use the narrow strips of plaster two inches wide, applying each one separately. To do this: Cut a sufficient number of strips of plaster the correct size and make the patient take a long breath and then "let out his breath" before the application of each strap. Overlap each strip half its width.

To Strap the Wrist.—To strap the wrist: Cover it with one-inch strips of adhesive plaster, applying them tightly and letting each one cover the other half its width and extend about two thirds around the wrist. Finish on either side with a narrow strip.

To Strap the Knee.—To strap the knee: Cut four pieces of one-inch adhesive plaster long enough

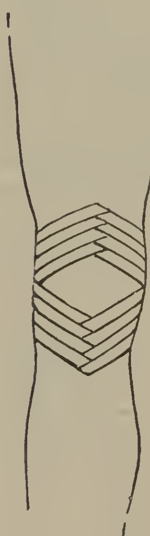


Fig. 81

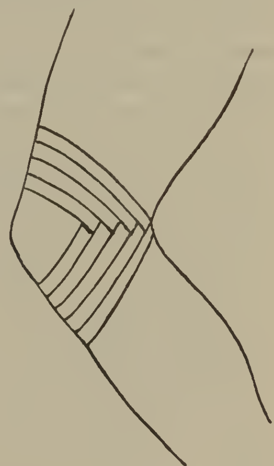


Fig. 82

Strapping of the Knee

to reach, when tightly stretched, from the middle of the leg just above and below the patella to the side of the latter. Cut twelve more strips, four of which are half an inch, four an inch, and four an inch and a half longer than the first ones. Surround the kneecap with the first four, stretching them very tightly and

crossing them in the center both above and below the patella and at the sides. Apply the next size in the same manner, overlapping the first half their width, and so on. The strapping must be very tightly applied, without wrinkles, and close to the patella. Cover with a tight figure-eight bandage.

To Strap the Ankle.—To strap the ankle: Place the patient's heel on a stool, put a bandage back of his toes and have him hold the ends so that his foot will be drawn forward. Stretch a piece of adhesive plaster down one side of the leg from about three inches above the ankle, crossing the point of injury. Pass it under the sole of the foot well toward the front and up the other side of the leg the same distance.[1] Stretch a piece of one-inch plaster down one side of the leg, beginning six inches above the ankle, under the heel, and up the other side an equal distance. Place a strip at the back of the heel, bring one end around to just about the little toe, and the other above the big toe.

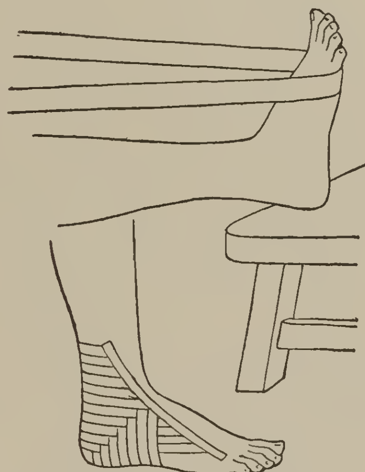


Fig. 83. Strapping of the Ankle

[1] This strip is to help hold the foot in position. It is under the rest of the strapping and does not show in Fig. 83.

Put on alternate strips in this manner until the point of injury is well covered, and finish with a narrow strip down either side, to prevent the ends curling.

Splints

Purpose.—Splints are to immobilize or give support to injured or diseased parts of the body.

Material Used for Splints.—In emergency, splints can be made of any material sufficiently stiff not to bend: umbrellas, canes, firewood, wooden slats, several thicknesses of cardboard, etc. Regular splints are generally made of either wood, plaster, or tin; also there are a great many special splints and braces made of leather and steel or other metal. Either plaster or wooden splints are generally used for uncomplicated fractures. Plaster splints have been already considered. Wooden splints are generally made of pine about a quarter of an inch thick, and usually such splints are wanted long enough to extend slightly beyond the joints above and below the seat of injury and just a little broader than the parts to which they are to be applied.

The side of the splint which is to go next the patient is padded and the splint is retained in place with a bandage, and, frequently, two or three narrow strips of adhesive plaster are put around the splint and the limb to which it is applied under the bandage. Basswood splints are usually very thin and pliable and are used to fit around an injured part. Generally, except when the injured part is small, as a finger, basswood splints are used only with other stronger splints. Coaptation splints, which are used to put around a fractured part, under a plaster or other splint, are

made of small strips of basswood held together with adhesive plaster. It seems hardly worth while describing the more complicated splints and braces, because, not only every hospital, but nearly every surgeon, uses different ones. There are, however, certain essentials to be remembered in the use of splints and braces whatever their nature.

Essential Care in the Use of Splints and Braces.—The following care is necessary to prevent pressure sores and interference with the circulation in the injured part: Wash the skin as often as possible with soap, water, and alcohol, and powder it, to prevent chafing. Pad either the splint or the injured part. Secure splints and braces tightly enough to keep them in place but they must not interfere with the circulation of the blood in the part. It must never be forgotten that a part may swell after the splint has been adjusted and the bandage thus become too tight, even though it was not so when put on.

To Pad Splints.—Flat splints are usually padded by covering the side that is to go next the patient with sufficient cotton-batting or similar material to make a soft pad over the surface of the board and to extend about one half inch beyond it on all sides so as to cover the edges. This is secured in place by taking a couple of turns with a bandage around the length of the splint and then bandaging the splint, taking either figure-eight or reverse turns.

Extensions

In fracture of the femur, it is generally necessary to make traction on the leg in order to overcome the contraction of the muscles which tends to displace the ends of the fractured bone.

Buck's Extension.—Buck's extension, or one of its modifications, is very frequently used in such cases. The necessary articles to prepare for the putting on of a Buck's extension are:

A pulley.

A screw to attach the pulley to the bed.

A rope and weights (the Volkman or other slide).

Blocks to elevate the foot of the bed.

A fracture board, if one is not already under the mattress.

Bed cradle.

A splint, or splints; the kind to be specified by the doctor.

Adhesive plaster.

Bandages. Gauze bandages are generally used to fix the moleskin, and unbleached muslin ones, unless a plaster cast is put on, to secure the splint.

Non-absorbent cotton, for padding.

A spreader, made from a piece of wood about one inch wide and three inches long, on which a strip of one-inch webbing is tacked; this must be long enough to extend about six inches on either side of the wood. There should be a hole in the center of the wood through which the rope holding the weights can be passed and knotted.

Matches, and an alcohol lamp, the latter to heat the moleskin.

Two pieces of moleskin with suspender-buckles attached. The moleskin should be long enough to extend, when folded over the buckle, from the side of the foot to the upper margin of the lower third of the thigh.

Prepare the patient's leg by shaving and washing, and drying it thoroughly.

To prepare the moleskin for use: Cut one end of each piece of skin as in Fig. 84 so that the buckles can be passed over them. Slip on the buckles, having the

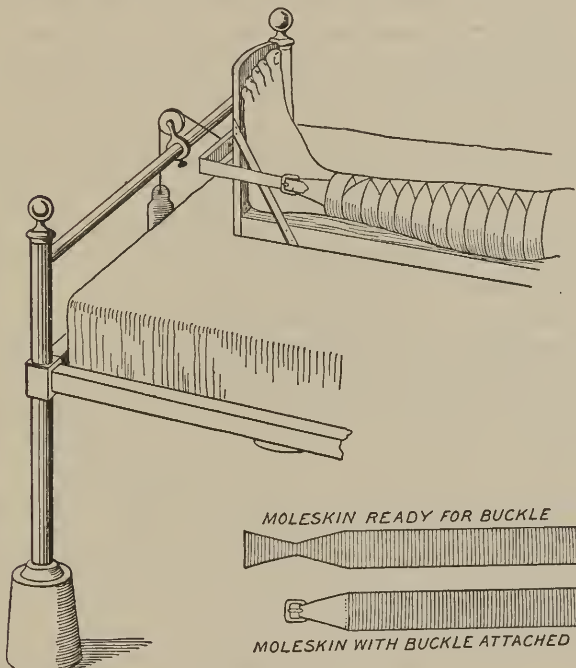


Fig. 84. Buck's Extension

clasp on the non-adhesive side. Take off about four inches of the gauze protecting the adhesive surface, turn back the lower part of the cut end of moleskin over the bar of the buckle and stitch it around the sides and top of the flap, the moleskin not being sufficiently adhesive to stand the strain of the weights upon the buckles.

Do not remove the protecting gauze from the upper part of the moleskin until the doctor is ready to use it. After removing the gauze, heat the moleskin, holding the non-adhesive side facing the flame.

To apply the moleskin: Fasten it to the sides of the leg, having the buckles just escaping the side of the patient's foot, and as the moleskin does not always stick very firmly at first, secure it with a bandage. Put on a splint or heavy bandage, fasten the ends of the webbing on the wooden cross-bar into the buckles. Put one end of the rope through the hole in the bar and knot it firmly, and pass the other end over the pulley and attach the weights to it.

Raise the foot of the bed on shock blocks. Put a bed cradle over the bed to keep off the bedclothes. While changing the bed, or performing any other work that involves moving the patient, rest the weights on the foot of the bed to relieve the traction, but do not forget to let them down before leaving the bed.

Vertical Extension.—Vertical extension is often used for fractures of the femur in young children instead of the Buck's extension, because the latter is useless if the patient sits up, as children will do. The articles required for this extension are with a few exceptions the same as for a Buck's. The exceptions are: An iron frame with a horizontal bar that crosses the width of the bed, about three feet above it, is used instead of the weights, and, as both the injured and uninjured legs are suspended, there must be two pieces of rope, two wooden spreaders with webbing attached, four pieces of moleskin, and four buckles. The shock blocks, bed cradle, and slide will not be necessary.

The moleskin is put on the child's legs as for a Buck's

extension. The ends of the webbing—which is attached to the spreaders—are fastened in the buckles; the pulleys are attached to the bar above the bed. One end of each piece of rope is put through a spreader and knotted, and the other end is passed over a pulley and tied to the foot of the bed. The child thus lies on his back with his legs held up under the horizontal bar of the frame. To cover the child's legs, put a folded sheet over the bar, letting it hang on either side of the child's legs; pin the two sides together. Slip the end of the outer side under the spread covering the foot of the bed and that of the inner side under the bedclothes covering the child. Usually, the bandages, etc., on the child's legs will keep them comfortable, but in cold weather the feet will require to be covered with something warm, and short socks made of soft flannel or old blanket answer the purpose very well.

The Bradford Frame.—The Bradford frame, which was described on page 177, is often used to prevent girl children soiling dressings on the thigh or pelvis with urine when they urinate involuntarily, and to prevent children getting bed-sores or to avoid pressure on wounds of the back. When used for the purpose first mentioned, two pieces of canvas are laced to the frame, one at the top and the other at the bottom, leaving a space at the center where the child's buttocks will come. The frame is tied to the bars of the crib in such a way that it is suspended a few inches above the mattress. The canvas must sag in the frame sufficiently for the child to be on, or slightly below, a level with the frame when it lies on small pillows or pads placed on the canvas. A bed-pan is placed on the mattress just below the aperture

in which the child's buttocks come. The mattress is covered with a sheet and spread, the frame and child with the usual bedclothes; as these hang over the sides they conceal the bed-pan. The pillow on the lower piece of canvas must be protected with rubber. If necessary the child can be restrained as described on page 177. The only difference in the arrangements, when the frame is used to avoid pressure, is in the location of the aperture or apertures, which must be under the injured parts.

CHAPTER XX

Care of Patients before and after Operation

Preparation of Patient for Operation. Probable Condition of Patient after Operation. Care of Patient after Operation. Special Points in the Care after Operations for Abdominal Infection, Perineorrhaphy, Gastrostomy, Tracheotomy. Complications that may Follow Operations.

Preparation of Patients for Operation

Reasons for Procedures of Preparation.—The detail of the preparation of patients for operation differs somewhat in different hospitals but the general principles are the same, for there are always three main objects in view: (1) To make the patient, especially at the site of operation, as clean as possible and thus remove one source of infection of the wound. (2) To empty the stomach, intestines, and bladder so that (*a*) the intestines or bladder will not discharge their contents when their sphincter muscles are relaxed under the influence of the anesthetic; (*b*) that an incision will not be made accidentally in any of these organs as sometimes happens in an abdominal operation when they are distended; (*c*) to prevent the entrance of solid substance into the trachea, a very probable occurrence if there is any solid food in the stomach; and (*d*) to obviate the intense nausea and auto-intoxication that are apt to

follow general anesthesia if there is much food residue in the intestine. The (3) principle to be borne in mind is, that if the patient is to make a good and rapid recovery from the effects of the operation and anesthetic, her strength must not be impaired, nor must she be tired out by the severity of the preparation.

General Preparation

Bath.—To avoid tiring the patient on the day of operation the bath is generally given the day before. It must be very thorough, and should include the washing of the hair unless this has been done very recently or the patient is too weak to stand it.

Bladder.—Always see that the patient voids urine shortly before operation. Some surgeons require a woman patient to be catheterized before an operation on the pelvic organs, so great is the danger of an accidental incision being made in the bladder if it is at all distended.

Catharsis.—Except for emergency operations a cathartic is given twenty-four hours before operation—one half ounce of compound licorice powder is very generally used, because it acts quickly and does not usually cause pain; also, it is not a hydragogue cathartic and unnecessary removal of water from the tissues before operation is a thing to be avoided. Between six and eight hours before operation a soapsuds enema is given. If there is much fecal matter in the result, as usually there will be unless the cathartic has been very effectual, the enema should be repeated, and it may be necessary to repeat it a second time. More than three enemata should not be given, however, with-

out the surgeon's permission, for too much distention of the intestine before operation often furthers a lack of peristalsis after operation. When an operation has to be done within a few hours, the cathartic is omitted and only the enemata given.

Diet.—The diet the day before operation should be of a highly nutritious nature and such as will not leave much residue in the intestines. No solid food is given after twelve hours before the time for operation, but strained soups and broths can be given until six hours before the operation and the patient is to be encouraged to drink water until six hours before operation; after that time water is the only liquid which is allowed and that in but small quantities.

Local Preparation

Between eighteen and twelve hours before operation, the field of operation and several inches of the surrounding skin are shaved and then washed (see pages 503 to 505) with hot water and soap, using a sterile cotton ball. The rest of the preparation varies greatly in different hospitals. One method in very common use at present is as follows: About six hours before operation the skin is wiped with a dry sterile towel and then painted with tincture of iodine, covered with sterile gauze, and a bandage or binder used to keep this in place. A second application of iodine is sometimes made by the surgeon after the patient is on the table, but in many hospitals only one application of the iodine is made. The iodine is applied with a sterile swab. There are three important things to remember in the use of iodine: (1) The drug is not to be poured from the bottle until it is

required for use, because alcohol evaporates very quickly when with iodine, and the tincture will consequently become so concentrated that, especially when the surface is covered with a dressing, the skin may be blistered. (2) Too much iodine is not to be used, too much being more than enough to make the skin a uniform light brown, or while the patient is conscious, to produce a sensation of burning. If too much iodine is used, the excess can be removed with alcohol. (3) The skin must be perfectly dry when iodine is applied, otherwise the action of the drug will be interfered with. For this reason, the skin is washed and shaved at least six hours before time to use the iodine, and for emergency operations the washing is omitted, and the shaving is done without soap. Another necessary precaution is to wipe the skin very thoroughly with a sterile towel before the application of the iodine so as to remove any moisture due to perspiration.

The advantages of this style of preparation are (1) that, as the iodine penetrates the skin in a way that other disinfectants do not, its action is more thorough; (2) the iodine method causes the patient much less annoyance than the wet dressing; (3) the skin, not being softened as it is by wet dressings, is in a better condition for the operation.

Wet Method of Disinfecting the Skin.—When disinfectants are used that do not penetrate the skin it is necessary to get it soft, and to cause free perspiration in the part that is to be prepared, so as to bring bacteria that are in the deeper layers of the skin to the surface. For this reason a warm wet dressing is left on for several hours, and some such régime as the following is used: After thoroughly washing the

surface to be disinfected a hot soap poultice—*i. e.*, compresses of gauze saturated in a 12 per cent. solution of green soap, 110° F.—is applied, covered with rubber tissue, and a bandage or binder put on to retain it in place. This poultice is usually left on for about four hours, then it is removed and the skin again scrubbed with soap and sterile water, using a sterile brush or swab for the purpose; the soap is washed off with hot sterile water and the skin is then washed with (1) ether, in order to remove all fatty substance, and (2) a disinfectant—alcohol 70 per cent. is often used. After the skin has been thoroughly cleansed, sterile gauze compresses wet in hot Harrington's solution,[1] bichloride of mercury 1:2000, or other disinfectant, are put on; these are covered with sterile rubber tissue, and a bandage or binder used to retain them in place. This dressing is left on until the patient is on the operating table, when it is removed and the scrubbing repeated.

Extent of Surface to be Included in Preparations.—For abdominal operations the abdomen and pubes must be shaved; the special washing is to include all the skin from the line of the nipple to the lower margin of the upper third of the thigh, special attention being paid to the umbilicus. Usually, only the abdomen is painted with iodine, but the application must extend for several inches on all sides of the field of operation.

For operations upon the neck it is usually necessary to shave the head on the side that is to be operated upon to above the level of the ear, but the surgeon

[1] Formula for Harrington's solution: Alcohol, 640 c. c.; muriatic acid, 60 c. c.; corrosive sublimate, 8 gm.; water, 300 c. c.; carmine, 2 gr.

should be consulted in regard to this, because, while it is essential to take off as much hair as necessary, it is also important to remove as little as possible. The ears must be very thoroughly cleansed and, just before operation, packed with sterile non-absorbent cotton. The local preparation should include the upper part of the chest, shoulders, and axillæ. The latter need not be shaved.

For operations upon a breast the entire anterior chest, upper part of the abdomen, both axillæ, the arm, shoulder, and side of that side on which the operation is to be done are to be included in the special cleansing; but only the chest, the arm above the elbow, and axilla on the affected side need be shaved, and for a small operation the arm need not be. The extent of surface to be painted will depend upon the nature of the operation. For amputation of the breast, or if extensive incisions are to be made, the painting must include the area which it has just been stated must be shaved.

Local Preparation for an Operation upon the Mouth.—For some time previous to operation an astringent and antiseptic mouth-wash and nasal douche are given every three hours. Solutions of permanganate of potash are often used for the purpose.

Local Preparation for Operations upon the Stomach.—In addition to the usual external local preparation the stomach is washed out with sterile water, the washing being continued until the water returns clear.

Local Preparation for Vaginal Operation.—The pubic region and the skin surrounding the external genitals are shaved. After the enemata have been given, the lower part of the abdomen, pubic

region, upper third of the thighs, and external genitalia are washed with (1) a 20 per cent. solution of hot green soap, (2) hot water. A green soap douche one and one quarter per cent., 115° F., is then given and this followed with a douche of lysol one quarter per cent. The patient is then dried with a sterile towel, a large pad of sterile gauze is placed over the vulva and surrounding parts, and a T-binder fastened over the gauze, to retain it in place. In some hospitals a third douche containing lysol or other disinfectant is given just before the patient goes to the operating room, and after the patient is on the table, a final scrubbing of the area of operation and surrounding parts is always given. Either lysol or green soap and hot sterile water are often used for the purpose.

Preparation for Operations on the Rectum.—This is the same as for vaginal operations, except that douches are omitted. Very copious soapsuds enemata are given.

Final General Preparation

Shortly before the patient leaves the ward for the operating room, long flannel stockings and a clean nightshirt are put on. If the patient be a woman, her hair is combed and braided in two plaits and her head covered with a muslin cap. The patient is encouraged to urinate, and if she cannot, unless she has done so recently, the fact is reported to the surgeon. Also, it is very important to ascertain if the patient has any false teeth on a plate, for, if so, they must be removed.

Probable Condition of Patient after Operation

Before considering the care of a patient after

operation it may be well to say a few words regarding the condition that the patient is likely to be in after an operation of any extent.

Usually, the principal underlying factor in the post-operative condition is the depression of the nervous system by the anesthetic. Due to this depression, the patient is rendered unconscious, and remains so for some time after the operation; and there is also great muscular relaxation. The muscular tissue of the heart, blood-vessels, and other viscera is relaxed as well as the skeletal muscles, and for this reason the blood tends to collect in the large blood-vessels in the interior of the body, and the circulation in the small superficial vessels is very poor. This constitutes the main condition of what is known as *shock*. Another effect of this loss of muscular tone is that the peristaltic action of the stomach and intestines is much lessened and, in the case of abdominal operations, this condition is made more pronounced by the handling and exposure which the intestines are subjected to during the operation. The tone of the stomach may be so much diminished that the organ will fail to contract when anything is taken into it; thus nothing will be passed into the intestine and, as very few substances are absorbed from the stomach, even water, if taken by mouth, probably will be vomited in a short time. Another common result of this lack of peristalsis is the accumulation of gas in the intestines, and this, if it becomes very great, may prove extremely serious, even fatal, because (1) if the intestines become very much distended they may be so paralyzed that it will be impossible to reduce the distention or cause the patient to have a movement of the bowels; (2) the distended intestines push the diaphragm up against

the heart and lungs, and this interferes seriously with the working of those organs. Another result of the general depression of the system by anesthetics is diminished oxidation. In consequence of this there is less heat produced in the body and the body temperature is thus often subnormal directly after operation, but it normally soon rises to, or above, normal as the result of the reaction that follows. Other conditions produced by general anesthetics are due to the irritating action of the drugs; the mucous membrane of the respiratory organs is always more or less irritated by ether and chloroform, especially the former, as is also that of the alimentary canal. The condition of the respiratory tract predisposes the patient to pneumonia and that of the alimentary tract to nausea. The kidneys, also, are irritated, partly by the irritating action of the drug they are endeavoring to eliminate, and partly by other unusual and irritating substances which they have to excrete. These substances are the result of the defective metabolism occasioned by the diminished oxidation, on account of which much of the material in the tissues that is usually broken down to carbon dioxide, water, and other simple substances that pass from the body in the respiration and urine, undergoes only partial decomposition. Occasionally the acids which arise from this defective oxidation poison the individual, inducing a condition known as *acidosis* or *acid intoxication*. Another abnormal condition that is of importance is the lack of fluids in the body. This causes the patient to suffer acutely from thirst and is harmful in several ways, the cells composing animal tissue being quite as dependent upon their normal supply of fluid as are plant cells. This lack of fluid is due to the purging

that precedes operation, the loss of blood in the operation, and the inability to take fluids by mouth, as well as to the effect of the anesthetic.

How pronounced these symptoms will be, and how long they will continue, depend very largely upon (1) the amount of anesthetic that is given, (2) the quantity of blood lost, (3) the patient's condition before the operation. But, if a general anesthetic is given even for a very short operation, to a healthy individual, the conditions just described will be present to some extent.

In addition to the symptoms already described there may be others occasioned by conditions existing before the operation; *e. g.*, if the operation was performed to relieve any septic condition, the symptoms of sepsis will be present in addition to those caused by the anesthetic. These symptoms will be discussed later. Also, the presence of the wound and all that it entails must be considered in summing up the condition of the patient. First, there are the severed blood-vessels, hemorrhage from which is prevented only, in some cases, by the clots which have formed at their openings, in others, by ligatures, which excessive movement of the patient and other causes to be discussed later, may make slip. Also, if the wound is closed, there are the sutured surfaces to be considered, for they could be easily pulled asunder, or, if the wound is not closed, it may be that there is infection, and the prevention of absorption is to be guarded against. Then, the incision, whether closed or open, is an avenue by which the germs causing sepsis and other dangerous conditions can enter the body.

Care of the Patient after Operation

Aim of Treatment.—The treatment of a patient after operation must be of a nature to counteract the effect of the operation upon the system, and to prevent the occurrence of the complications that may arise either as the result of the effect of the operation, or of the conditions for which the operation was performed.

Important Items in the Care of Patients after Operation.—These are as follows:

An ether patient must never be left alone until she has entirely recovered consciousness.

To counteract the conditions of shock and poor superficial circulation, and to prevent the contraction of pneumonia, the patient must be put into a warmed bed and covered with warmed blankets. See page 137. Usually she must be kept covered in this way until she has recovered consciousness, and her skin is warm. In many hospitals it is against the rules to leave hot-water bottles in the bed unless they are ordered by the surgeon, the reason for this rule being that many ether patients have been burned by hot-water bags; such burns occurring very easily when the circulation of blood in the skin is as poor as it is when the nervous system is depressed by an anesthetic. If hot-water bags are left in the bed they must be put into flannel bags and there must be at least one fold of blanket between the patient and the bag. See page 395. The patient's skin must be watched—it must not be allowed to become in the least red; the nurse who puts the bags in the bed must make such inspection just before she goes off duty, also she must tell the nurse who relieves her how many bags there are and their location.

To avoid the starting of hemorrhage, or strain on the stitches of a sutured wound, or, if the operation has been for the relief of an abscess of any of the abdominal organs, the scattering of septic matter, the patient must be (1) very carefully lifted into bed. One method of doing this is to have a folded sheet on the stretcher under the patient's buttocks and upper part of the thighs, and, after the stretcher is lifted on to one side of the bed, one nurse, standing on the far side of the bed, grasps one end of this sheet, another nurse, standing at the side of the bed on which the stretcher is placed, takes hold of the other end, a third nurse takes hold of the patient's legs, and a fourth supports the patient's head and also grasps her under the arms. The patient is then lifted into the center of the bed and the stretcher and sheet withdrawn. See page 139. (2) The patient must be kept as quiet as possible, though, sometimes, if movements of the legs and arms will not affect the wound, it is well not to restrain these parts too strictly, as doing so may excite the patient and make her more restless. After a patient has recovered consciousness one of the things necessary to keep her quiet is to make her comfortable. Some of the means of doing this are, rubbing the back with alcohol; placing a pad, small pillow, or hot-water bag partially filled with *warm* water under the hollow of the back; placing a support under the knees as described on page 153, to relieve strain on the abdominal muscles. (3) When a patient is retching severely after an abdominal operation, a nurse should keep a hand on the abdomen, making slight pressure toward the wound.

The relaxed condition of the muscles of the tongue make the falling back of that organ over the trachea

a very probable accident unless the patient is watched, and the relaxed state of the muscles of the trachea make the entrance of vomited matter into the trachea and bronchi an equally easy matter. Either of these accidents may result in asphyxia of the patient, or the entrance of solid matter into the bronchi may start a foreign-body pneumonia. To prevent these accidents, an ether patient must never be left alone and, especially while vomiting, her head should be turned on one side and low; this position favoring the flow of vomitus from the lower angle of the mouth and making it less easy for the tongue to cover the trachea. Pressing the fingers on the neck, just below the angle of the lower jaw, over the muscles at the base of the tongue, also helps to keep that organ forward. When it is necessary to do this it is usually necessary at the same time to make pressure against the angle of the lower jaw so as to press the jaw slightly forward and thus prevent the patient clinching her teeth.

To provide the system with fluid and thus (1) stimulate the heart action, (2) flush the kidneys—and thereby minimize the irritation by the foreign substances they must excrete,—(3) provide the tissue cells with the fluid they require, and (4) lessen the patient's thirst, normal salt solution is introduced into the body either by way of the rectum—enteroclysis or protoclysis—or subcutaneously—hypodermoclysis.

The intense thirst from which ether patients suffer can be, in addition to the means mentioned in the preceding paragraph, best relieved by washing the mouth frequently with a mouth wash. A wash consisting of one dram of albolene and lemon-juice to one ounce boric acid two per cent. is often used.

If the patient is allowed to have ice, crush the ice very fine and put it on a piece of gauze tied over the mouth of a tumbler so as to drain the water off and thus prevent the ice melting quickly. Place the glass with a spoon on a saucer. When water is allowed, give it either hot or very cold, otherwise it is likely to cause nausea, and, if the patient has been vomiting, give the water in very small amounts. Occasionally a surgeon allows a patient to have a copious drink of water even though she is nauseated, but this must not be done without permission, because, though in many instances it will not make any difference if the patient does vomit the water, there are cases in which it might cause harm.

When the patient is very much nauseated, lavage is frequently prescribed, for owing to the irritated condition of the mucous membrane of the stomach there is an overabundant secretion of mucus and other gastric secretions and removing this lessens the nausea. It is very important to try and prevent the patient becoming excited by the treatment. Ice is sometimes given to relieve nausea and it should be prepared as described in the preceding paragraph, the pieces of ice being small enough to be swallowed as ice. In order to lessen the danger of nausea secretions should be removed from the mouth and nose with gauze pledgets as soon as they collect, and, if the patient vomits after she is conscious, her mouth should be washed with mouth wash each time she does so.

A patient may be unable to void urine voluntarily after operation. This may be due to nervousness or to dulling of the senses by the anesthetic. On account of the unusual substances likely to be contained in the urine it is particularly important that it should

be voided; therefore, if the patient has not urinated ten hours after the operation, the surgeon should be notified. The urine, whether voided voluntarily or obtained by catheter, must be measured for at least forty-eight hours after operation, and longer if (1) there is any abnormality in the amount voided, (2) in the character of the urine, or (3) following operations on any of the urinary organs. A specimen of urine is always sent to the laboratory the morning after operation and, usually, daily, if there is anything abnormal in the character of the urine, or after an operation on any of the urinary organs.

The diet is of importance after operation. At first, due to the lack of peristalsis and irritated condition of the alimentary canal, food cannot be given, for it would cause distress and be vomited, but, as soon as possible, the patient should be given, and encouraged to eat, all the nourishing food possible. If, as is sometimes the case, the patient continues to be nauseated for some days after the operation, great caution must be observed in the giving of nourishment; it must be liquid, but as concentrated as possible, and given in small amounts at a time. Partially digested foods, such as peptonized milk, are often used. Food which the patient likes is often more likely to be retained than that for which she does not care.

Special Treatment Following Certain Operations

Abdominal Operations when there is Infection.—In the upper part of the abdomen are a large number of lymphatic glands, and one of the very important items in the treatment of a patient who has been operated upon for a septic condition of any of the

abdominal organs is to place her in such a position that septic matter will be kept away from these glands, and drainage through the wound secured. Other important parts of the treatment are: (1) Keeping the patient quiet so that any localized septic matter will not be scattered through the abdominal cavity; (2) flushing the system with fluid—see page 366; (3) giving the patient all the nourishment possible. The position in which the patient is usually placed is the dorsal position with the knees flexed and supported as described on page 153 and the head of the bed elevated about eighteen or twenty inches above the level. This is called the Fowler position, after Dr. Fowler, one of the first surgeons to advocate its use. The name is given also to the position which is sometimes used instead of the one just described, in which the patient is propped up on pillows in a sitting position—see page 154; the knees are flexed and the head of the bed elevated as in the former posture. When the patient is in either of these positions means such as those described on page 152 must be taken to prevent her slipping down in bed, and, as the sitting posture after operation involves considerable strain on the heart, the greatest care must be taken to arrange the pillows so that she will be thoroughly supported. Also the pulse must be felt frequently and any change for the worse reported to the surgeon at once.

Care of Patient after Perineorrhaphy.—Perineorrhaphy is the suturing of the perineum. The success of this operation is very dependent upon the care which the patient receives after it. Some of the important items in the necessary nursing care are as follows: For the first forty-eight hours, and longer if the patient is restless, the knees should be bound

together to avoid any strain on the stitches when the patient moves. If there is the slightest straining during defecation, the nurse should put on a sterile rubber glove, or wrap her hand in sterile gauze, and hold the sutured parts together. Some surgeons require an oil enema to be given before each defecation to soften the fecal matter. In addition to the danger of the stitches being broken by straining there is also that of infection. To avoid this the stitches and surrounding tissues must be most carefully irrigated and dried after every defecation and micturition. The irrigation can be done either with a syringe or with the douche apparatus, using a glass pipette instead of a douche nozzle. In irrigating regulate the flow of water so that it is very gentle, and be sure to remove all foreign substance. Dry the parts thoroughly by gently pressing sterile sponges against the surface. Apply a sterile gauze dressing, cover with a sterile pad, and keep in place with a T-binder. To avoid irritating the stitches, many surgeons require perineorrhaphy patients to be catheterized for at least twenty-four hours after the operation. When douches are ordered it is generally better to substitute a straight glass catheter for the ordinary douche nozzle.

Care of Patient after Tracheotomy.—Tracheotomy is performed for obstruction in the trachea at a point too low to be benefited by an intubation tube. This obstruction may be due to disease, foreign bodies, or injury. An opening is made in the trachea, and a tracheal tube inserted in the aperture. These tubes consist of two curved tubes, one smaller than the other and fitting inside of it, being secured in place by the small clasp on its upper end. The outer

tube is provided with two metal loops through which sterile tape is passed. The tape is fastened around the patient's neck and the tube thus held in place. So long as there is any danger of the tube becoming blocked, the patient must not be left alone for a minute and the tube should be cleansed as often as necessary, which sometimes means every few minutes. This is done either by removing the inner one, washing it quickly in sterile water or salt solution, drying it with sterile gauze, and reinserting it, or else by leaving the tube in place and cleansing it with absorbent gauze wound tightly around a curved probe, being careful of the following points: To have the gauze dry and to roll the raw edges innermost so that no loose thread will be left in the tube and so get into the trachea; to have the gauze sufficiently long to allow of its being held and all risk of its slipping from the probe thus prevented; not to have the roll large enough to obstruct the tube. Remove this gauze from the probe with forceps, not the fingers. This method should not be used when there is much discharge in the tube. Two or three thicknesses of gauze wet with sterile water are kept over the mouth of the tube; this is to filter and moisten the air. So long as it is necessary to cleanse the tube frequently, a tray covered with a sterile towel and holding the following articles should be kept near the bedside: a basin of sterile water or salt solution, for the washing of the tube—this should be changed frequently,—sterile gauze, scissors, forceps, and a disinfectant for the hands. The whole should be kept covered with a sterile towel.

Method of Feeding Patient after Gastrostomy.—When there is a stricture of the esophagus, or

cardiac end of the stomach, an opening is sometimes made in the abdominal and stomach walls and a catheter inserted in the opening through which the patient is fed. The utensils necessary for giving food in this manner are: a graduated glass or pitcher containing the feeding, a small funnel, with about twelve inches of rubber tubing attached, and a glass connecting tube to connect the latter with the catheter. To give the feeding, expel the air from the tubing by filling the funnel with liquid and letting a small portion of it flow through the tube, unclamp the end of the catheter (the catheter is always kept clamped between feedings), insert the connecting tube, and let the fluid run in very slowly. Never allow the funnel to become empty, or air will be introduced into the stomach. Be exceedingly careful in handling the catheter; there is danger of its slipping both into and out of the stomach. After the feeding, clamp the catheter carefully, to prevent the fluid escaping from the stomach. The kind of food that is given depends upon the nature of the case; any form of fluid food can be given in this way. The catheter is usually so arranged that it is not necessary to remove the binder to give the feeding; when this is not the case, the dressing on the abdominal wound must be carefully protected with a sterile towel or other sterile protector. Three or four weeks after the operation the catheter is removed, and it is then necessary to reinsert it before each feeding.

After an operation in which an incision is made in one side of the back the patient generally lies on the unaffected side, except when drainage is required as after operation on a kidney; in either case the patient must be supported with pillows.

Following operations on a leg or thigh it is often necessary to place sand-bags along the side of the limb to maintain it in a fixed position and to put a bed cradle or substitute over the injured part to prevent pressure of the bedclothes upon it.

Complications that may Follow Operations

The complications most likely to follow operations are:

Asphyxia.—As stated on page 511, unless a patient is watched while under the influence of an anesthetic, asphyxia can easily occur. The danger is greatest after emergency operations when the patient had a meal shortly before the giving of the anesthetic. The treatment is described in Chapter XXIV.

Hemorrhage.—Hemorrhage following operation is often spoken of as primary hemorrhage—that occurring within twenty-four hours of the operation; and secondary—that which occurs later. Profuse primary oozing and hemorrhage are usually due to one or other of the following causes: (1) Owing to the depression of the heart by the anesthetic there is no flow of blood from vessels which should be tied, and consequently they are unnoticed by the operator, but later when the heart regains its tone, especially if the patient is restless, the blood is pumped through these vessels with sufficient force to dislodge the clots that have formed. This is most likely to occur in patients who are anemic or those suffering from general debility before operation. (2) Slipping of a ligature; this is most likely to occur when the patient is very restless. (3) Failure of the blood to clot; the very small blood-vessels are not all tied in an operation,

but normally hemorrhage is prevented by the clotting of the blood at the cut ends of the vessels and the retraction of the vessel walls. Occasionally, however, due usually to some abnormal condition of the blood, as when a patient is jaundiced, has diabetes, or the condition known as hemophilia—see Chapter XXV,—clotting does not occur. Secondary hemorrhage occurs most frequently in septic wounds, as the result of erosion of the walls of the blood-vessels, or slipping of ligatures due to the condition of the ligated vessels. Also, of course, ligatures may slip in even a healthy wound if the patient is very restless. Secondary hemorrhage is very likely to occur from a large vessel, because the smaller vessels are nearly always occluded after forty-eight hours

The symptoms of hemorrhage are a growing pallor; weak, shallow, sighing respiration; thirst; a longing for fresh air; vertigo; a weakening of the pulse beats, which become also rapid and irregular; a falling temperature, and, usually, the presence of blood on the dressings. These symptoms with the exception of that last named are the natural result of the loss of fluid, oxygen, and heat by the tissues, due to the loss of blood. In some instances, especially after operations on the abdominal or pelvic organs, the blood may not escape, but may collect in the abdominal cavity.

The treatment of hemorrhage will be discussed in connection with emergencies, Chapter XXIV.

Shock.—The condition of shock is due to depression of the nervous system in consequence of which all the vital organs and activities are depressed. It occurs most frequently in elderly people, young children, and individuals whose health is poor.

The symptoms of shock, except that there is no loss of blood, are the same as those of hemorrhage; because, due to lack of tone of the muscular tissue of the heart and blood-vessels, a large quantity of the body's blood supply remains in the large abdominal vessels and, when there, is of no more use to the tissues than if it had escaped from the body.

The essentials of the treatment of shock are to elevate the foot of the bed so as to keep the blood as much as possible in the brain, lungs, and heart; to apply heat around the body; a greater amount of fluid is usually provided by giving either an enema, clysis, or intravenous infusion (the clysis is usually, and the infusion always, given by a doctor). Sometimes, except after an abdominal operation, small sand-bags or other weights are placed on the abdomen to prevent congestion of blood in the large abdominal vessels.

Retention of Urine. Retention with Overflow. Cystitis.—For the reasons given on page 512 retention of urine is a very common complication of operations and sometimes what is known as *retention with overflow occurs*; *i. e.*, the patients void urine constantly in small amounts or else there is a more or less constant leakage from the bladder, but the bladder fails to contract and entirely expel its contents. The symptoms are the constant passing of urine and, as can be ascertained by percussion, the bladder extends above the pelvic cavity. Cystitis, or inflammation of the bladder, following operation, unless the operation has been upon one of the urinary organs, is almost invariably the result of careless catheterization.

Abdominal Distention.—This is one of the most

common complications following operation. It is nearly always due to a collection of gas in the intestines. The causes and results of this distention were discussed on page 220.

It is most essential that the condition be recognized at the onset, so that, if there is any tendency for it to increase beyond the expected degree, treatment can be started at once; for the more distended the intestines become, the more difficult it will be to get rid of the gas.

Fever.—As previously stated there may be, normally, a slight rise of temperature—100° to 101.5° F.—shortly after operation and it may continue this high for twenty-four or forty-eight hours, and lower, but not quite normal, for several days. Also there will be a corresponding increase in the pulse rate and respiration. The course of the temperature should be even, however, and the rate of pulse and respiration should be in keeping; any sharp deviation in either of these respects is to be regarded with suspicion. Some of the more common causes of an unusual rise of temperature are: (1) auto-intoxication due to absorption of matter from the intestine, lessened activity of the skin, kidneys, and liver, or the retention of secretions which should drain from the wound. (2) infection of the wound; (3) sepsis; (4) peritonitis; (5) pneumonia; (6) embolus.

Auto-intoxication.—Fever due to auto-intoxication —*i. e.*, intoxication or poisoning produced within the body—will be associated with headache and malaise, but, usually, these symptoms will not be severe nor the fever high and they will be relieved by a good movement of the bowels. When this is not the case, a more serious cause for the fever is feared.

Infection.—Infection of the wound occurs as the result of the entrance of some variety of pus-producing bacteria. The symptoms will depend upon the severity of the infection; if this is slight the symptoms may not be very pronounced. Those usually present to some extent are: A rise of temperature with a corresponding increase in the pulse and respiration, pain and swelling in and around the wound. If the infection is severe, there may be a chill, headache, and general malaise due to the absorption of toxic substances produced by the bacteria.

Sepsis.—If absorption of toxic substances occurs, the patient, unless measures to arrest the absorption and drain the wound are successful, is likely to become septic and either septicemia or pyemia result. In former days these diseases were very common complications of operations, but the aseptic measures of the present day have caused them to become exceedingly rare, except when infection exists before the operation. Further description of these two diseases will be found in Chapter XXV.

Peritonitis.—Peritonitis, *i. e.*, inflammation of the peritoneum, may be due to perforation of a suppurating appendix or visceral abscess; to rupture of the intestine or other abdominal or pelvic organ; to extension of a septic process from adjacent structures; to general infections, as septicemia, tuberculosis, etc., or to traumatism. Formerly, it occurred frequently as the result of wound infection. Peritonitis may be either local or general; *e. g.*, in some cases of appendicitis, the loop of intestine around the appendix, on account of the inflammatory condition which spreads to it from the appendix, becomes stuck together, forming a wall around the appendix, and any pus that

collects is thus shut off from the rest of the abdominal cavity; the wall is not very secure however, and if the individual makes strenuous movements, either before or after operation, the septic matter is likely to pass into the cavity. This infection will be further described in Chapter XXV.

Pneumonia.—Post-operative pneumonia is a complication that must be always guarded against after a patient has had a gaseous anesthetic. The exciting causes other than the irritated condition of the respiratory tract may be: (1) Exposure of the patient while the circulation is still depressed by the anesthetic, in consequence of which the superficial blood-vessels will be contracted and the congestion of the blood in the irritated lungs and bronchi thus increased. (2) Irritation due to inspiration of secretions from the mouth and nose or of matter vomited during anesthesia. (3) Infection carried by the blood from some other part of the body—*e. g.* an infected wound. (4) Embolus. (5) Remaining too long in one position. This is known as hypostatic pneumonia. Elderly people and individuals with heart disease are particularly susceptible; therefore such patients, if possible to avoid it, should not be allowed to remain too long in one position. A rise of temperature associated with disproportionately rapid respiration is suggestive of pneumonia. See Chapter XXV.

Thrombus and Embolus.—Ordinarily blood does not clot in the living blood-vessels, but if a vessel becomes diseased or injured in any way—as may happen in operation—or if any foreign body, even air, enters a vessel, a clot may form; such a clot is called a *thrombus*. If a thrombus is dislodged and carried off in the blood stream, it is known as an *embolus*,

and the process is spoken of as *embolism*. When an embolus becomes lodged and stationary, it is once more called a *thrombus*. The result of the formation of a thrombus will depend upon where it lodges and whether it is sterile or infected. If a sterile embolus lodges in a vessel which has anastomosing branches, it will do no harm, but if it enters and occludes an artery that does not anastomose with other arteries, the tissue which the vessel should supply with blood will die for lack of nourishment. Such areas of tissue are called *infarcts*. If the infarct is small absorption of the dead tissue usually follows, with the formation of a cicatrix, but a large infarct in any of the vital organs is likely to cause death. An embolus lodging in a large vessel of the heart or lungs is very likely to cause sudden death. If one obstructs a cerebral vessel, paralysis of the part of the body supplied with nerves from the affected portion of the brain will follow, and if this part is one of the vital organs death will result. An infected embolus is likely to form the starting point of an abscess wherever it lodges. For further information see Chapter XXV.

CHAPTER XXI

WOUNDS AND SURGICAL DRESSINGS

Different Kinds of Wounds. The Healing of Wounds. Nature and Causes of Some of the More Common Abnormal Conditions that Occur in Wounds. Means of Preventing these Conditions. Methods of Cleaning and Sterilizing Instruments and Utensils Used for Surgical Dressings. Nature and Care of Material Used for Surgical Dressings. Disinfection of the Hands, etc. Preparation of Dressing-Carriage and Patient for Dressings. Assisting with Dressings. Technique of Surgical Dressings.

BEFORE discussing the methods of dressing wounds we will consider briefly some important facts relating to the nature and healing of wounds and the conditions which may interfere with their healing.

DEFINITION.—Wounds have been described as "breaks in the continuity of tissue."

DIFFERENT KINDS OF WOUNDS.—According to their nature, wounds are known as:

Aseptic wounds;—*i. e.*, those not infected by pathogenic bacteria.

Septic wounds—*i. e.*, wounds that are so infected.

Contused wounds—*i. e.*, those that are associated with more or less bruising and crushing of the tissue.

Incised wounds—*i. e.*, wounds such as are made by sharp instruments and are not complicated by any tearing of the tissues.

Lacerated wounds—*i. e.*, those in which the tissues are torn.

Punctured wounds—*i. e.*, wounds such as are made by pointed instruments, or gunshot wounds.

The Healing of Wounds

Physiology of Healing.—When a wound is made in any part of the body, either by accident or design, a blood-clot forms between the cut edges, and there is also, due to the irritation, a larger amount of blood than usual in the surrounding tissue. In other words, there is congestion; this, however, unless the tissues have been badly injured or become infected, will be but slight. The presence of this extra supply of blood in the part encourages the growth and subdivision of cells, and thus new cells are formed rapidly. These enter the blood-clot and form new tissue; also, new cells spring from cells composing the tissues of the cut blood-vessels and form small loops on the vessels. These extend into the new tissue and serve to hold its blood supply.

Different Ways of Healing.—The sides of an aseptic, incised wound, in which there is no cavity due to loss of tissue will, if brought into apposition, grow together in a few days, and the wound is then said to have healed by *first intention*, *by apposition*, *by primary union*, or *per primam*. If, on the other hand, the edges of the wound are allowed to gap, or if they are not brought into apposition until the conditions conducive to rapid healing have passed, or if a large cavity exists, or if inflammation and consequent suppuration and destruction of tissue occur, the healing process may be much delayed and associ-

ated with the formation of small rounded masses of tissue, known as *granulations*. When the repair of a wound takes place in this way, it is said to heal by *granulation*, *second intention*, or *per secundam*.

Granulations.—Granulations grow from the sides and bottom of a wound and gradually fill up the cavity in the following manner: The individual granulations consist of newly formed capillary sprouts surrounded by new connective-tissue cells. The capillary processes in adjacent granulations unite and thus form new blood-vessels, and the connective-tissue cells around the capillaries elongate and join the cells of other granulations and thus new tissue is formed. The skin is restored by multiplication of the epithelial cells around the edges of the wounds. The granulating surface of a normal wound is bathed with a thin pus. Sometimes the granulations do not grow as quickly as they should; they lose their red color and become grayish and shrunken, and the individual granulations are small, and there may be spaces between them. Also the surface of the wound becomes drier than it should be or there may be a thick tenacious secretion. When this is the case, balsam of Peru, or some other drug, possessing similar properties, is generally used to stimulate the growth of the granulations. On the other hand, granulations may grow too exuberantly; in such case they are soft, large, and bleed easily. This condition is sometimes the result of irritation due to the constant shifting of a badly applied dressing, or to the presence of a foreign body such as a retained ligature. Such granulations are removed—either by the use of a caustic, such as nitrate of silver, by cutting with a scissors, or by curetting—for they interfere with the proper healing

of the wound and favor the formation of unsightly scars.

Cicatrix or Scar.—Even when the newly formed tissue reaches the level of the body and is covered by the skin it is not the same color as the surrounding skin, but is of a pink color and will become quite red if the wounded portion of the body is exerted, due to congestion in the small blood-vessels. This mark is known as the *cicatrix* or *scar*. The pink color gradually fades until the scar is even whiter than the normal skin, and it will remain so, if the wound was of any extent, on account of the absence of pigment in the new skin. The scar tissue is at first elastic and is often stretched by the tension which the less elastic skin exerts upon it; thus the width of the scar is at first often increased, but after a short time the cicatricial tissue loses this elastic quality and becomes even less elastic than the skin. On account of this inelasticity of scar tissue, loss of function in a part, due to cicatricial contraction, is one of the dangers attending extensive injuries to the tissue, and certain operations—*e. g.*, normal movement of an arm is sometimes rendered impossible on account of the contractions of the scars resulting from amputation of a breast.

Factors which Help the Rapid Healing of Wounds.—The factors which are of the greatest importance in securing rapid healing of wounds, firm union of the deeper tissues, and healthy scar tissue are: a normal condition of the blood, good circulation of the blood in the wounded part, absence of infection, and, especially for a wound healing by primary union, sufficiently restricted movements to prevent any displacement of the wounded parts that

have been brought into apposition. If an individual is suffering from any disease that gives rise to changes in the normal constituents of the blood, the healing of a wound is likely to be very much affected. This is more especially the case in diabetes or conditions causing jaundice and in severe anemias. Another important factor in the healing of wounds, is age—cell growth takes place much more rapidly in youth than in old age, therefore children's wounds heal more rapidly than those of elderly persons. On account of the influence of the blood-supply on the healing process, wounds in the parts of the body where blood and lymph vessels are especially numerous—*e. g.*, the head and face—will heal more quickly than those in parts where there are fewer vessels. The depth of the wound is another influence, a superficial wound healing more quickly than a deep one; thus a superficial wound of the face, under normal conditions, will heal in five days, and a deep one—in the abdominal wall, for instance—under equally favorable conditions, will require about fourteen days to unite, and it will be a much longer time before the part will be able to stand any strain. Wounds healing by second intention will take longer than those healing by primary union, but they, even more than the latter, will be influenced by the conditions just mentioned.

Means that must be Taken to Secure Rapid Healing.—To secure as many of the favorable conditions for the healing of wounds as possible, it is necessary to see that patients with extensive wounds are well fed and that their surroundings are hygienic in every respect; that there is no strain upon parts that have been brought into apposition; that wounds

are properly dressed—this will be discussed later—and that they do not become infected.

The Nature and Cause of Some of the More Common Abnormal Conditions That Occur in Wounds

Infection of Wounds.—Wounds will be septic that are made in infected tissue in order to afford drainage and so remove material that otherwise might be absorbed and produce a general septic condition. Wounds resulting from accidents are apt to be infected, because bacteria are very likely to be introduced under the skin by the implements causing the wounds, but, except under such conditions, infected wounds are usually the result of somebody's carelessness. Pus-producing bacteria introduced into a wound may give rise merely to local inflammation, but they may be absorbed from the local lesion into the lymphatics or blood-vessels and cause general septicemia or pyemia. This, until recent years was a very common occurrence, but as the result of improved aseptic measures and better knowledge of how to treat infected wounds, it is now a rare thing for such diseases to follow operation. Slight local infections, however, still occur with unnecessary frequency, and, as even a mild infection is likely to necessitate opening the wound in order to afford drainage, it will interfere with the healing process. The symptoms of infection other than those directly connected with the wound were discussed in Chapter XX.

Stitch Abscesses.—A form of slight infection that sometimes occurs is the stitch abscess—*i. e.*, a small abscess formed around a stitch or stitches. Stitch

abscesses are thought to be due most frequently to germs in the skin which are carried into the tissues by the surgeon's needle or to unsterile suture material, but, of course, they may be the result of unsterile needles, instruments, hands, etc.

INFLAMMATION[1] AND SUPPURATION.—Inflammation occurring in wounds that should be aseptic is usually the result of the entrance into the wound of the staphylococci or streptococci pyogenes. When these bacteria enter a wound the toxic substances they produce cause irritation, in consequence of which a larger amount of blood flows to the part and thus the signs of inflammation—redness, swelling, pain, and heat—are produced. The redness is caused by the large amount of blood in the blood-vessels; the swelling, by the engorgement of the vessels and consequent passage of an excessive quantity of blood-plasma and white corpuscles from the vessels into the tissue; the pain is due to irritation of the nerve endings by the bacterial products and also by the pressure on the nerve-endings resulting from the excessive amount of fluid and the comparatively large amount of solids in this fluid; the heat is occasioned, at least in part, by the active chemical changes that take place, in consequence of which there is increased heat-production. Inflammation in wounds usually goes on to suppuration —*i. e.*, the disintegration or breaking down of the tissue and its discharge in pus. Pus consists of blood-plasma, white blood-corpuscles, a few red corpuscles, bacteria and bacterial products, and disintegrated tissue.

ERYSIPELAS.—This is an inflammatory condition excited by the entrance into the wound of a variety

[1] See also the section on Inflammation, Chapter VIII.

of streptococcus pyogenes known as *streptococcus erysipelatis*. The disease is usually ushered in with a chill, which is followed by a high irregular temperature and all the conditions associated with fever. The distinguishing feature of the disease is the appearance of the inflamed area, which is smooth and glazed and, except in erysipelas of the scalp, of a deep crimson hue, and the color, instead of gradually fading into that of the skin, as in other forms of inflammation, usually ends in a sharply defined ridge. Sometimes, after a few days, the inflamed area becomes covered with minute blebs or vesicles. It is very important that erysipelas be recognized at once, as otherwise the wounds of other patients may become infected. The patient, if in a surgical ward, must be isolated immediately, and the nurse caring for her must not have anything to do for surgical or obstetrical patients. The erysipelas streptococcus, however, only causes infection when it gains entrance into the tissues through abrasions in the skin or mucous membrane, and therefore a patient with erysipelas is only dangerous to those who have wounds.

Gangrene.—Gangrene—*i. e.*, death of tissue while it is still attached to the living body—was, until aseptic measures were established, a very common outcome of the inflammatory conditions that usually followed operations. It is now almost unknown from such a cause, but it sometimes occurs when the wound is the result of accident and there is much destruction of tissue, or if the blood was shut off for any time in order to control hemorrhage. The condition is characterized by necrosis of the granulations and the formation of small abscesses and grayish-brown patches on the surface of the wound. There is usually

a profuse exudation and, as the condition grows worse, a very foul odor.

Gangrene of a limb below the point of injury may follow accidents or operations in which it has been necessary to shut off the blood from the part longer than forty-five minutes. The primary symptom is an increasing loss of sensation; this is followed by edematous swelling, and the surface of the affected part becomes covered with blebs and blisters and assumes a bluish hue, which gradually changes to green or black as the blood pigment breaks down. There is a varying amount of discharge and a foul, characteristic odor. The condition usually starts at the distal end of the part and advances upward until tissues are reached where the circulation is sufficiently good to supply them with nutrition. The principles of the treatment are to keep the part warm, quiet, and in a horizontal position; bandages and dressings must be applied very loosely so that they will not interfere with the circulation; and everything possible must be done to improve the patient's general health. Unless the gangrenous process can be controlled, the limb is usually amputated, as otherwise absorption of the septic material will take place and general sepsis follow.

Tetanus.—Tetanus, or lockjaw, is a disease due to infection by the bacillus tetani which finds entrance into the body through wounds. The bacillus tetani is a very prevalent organism and exists in especially large numbers in the soil, particularly in manured fields. Fortunately, it requires special conditions for its propagation in the human body and this prevents its being as common a form of infection as otherwise it might be. It is most frequently associated with deep,

lacerated wounds in which grains of dirt and soil have been embedded, and is especially common as the result of wounds made with toy pistols. One reason for this is thought to be that children playing with such things are likely to have their hands dirtied with soil, and the deep puncturing wound made by the shot drives the bacilli present in the soil deep into the tissue and thus provides the organisms with the conditions they particularly need, viz., absence of air, and macerated tissue. The symptoms usually develop about a week after the accident. The special symptom is the growing rigidity of the muscles, beginning with those of the jaw and neck. This disease will be further discussed in Chapter XXV.

ULCERATION.—Ulceration is a suppurative inflammatory condition, associated with destruction of tissue, that occurs on free surfaces, either those covered by skin or by mucous membrane. When ulcers occur in connection with wounds, they are usually due to some one or other of the conditions described on page 529, more especially diabetes and, in elderly people, general ill-health. Also, ulcers occur on the external surface of the body in connection with syphilis and with varicose veins without there necessarily being any previous wound.

SINUSES.—Occasionally a deep wound, that heals by second intention, will heal until only a small channel remains open, but this opening persists in spite of treatment. Such a cavity is called a sinus. Sinuses are often due to the presence of some foreign body, such as a retained ligature, piece of gauze, etc., but they occur also without any such cause when the patient's health is poor and, in such case, fresh air, nourishing food, and all the other hygienic measures

necessary to promote good health are very essential for the growth of the new tissue necessary to fill in the cavity.

Precautions Necessary to Avoid Infection

The introduction of bacteria into a wound being fraught with so much danger to the individual, the strictest asepsis must be maintained in dealing with wounds. Not only must everything that will come in contact with a wound be rendered sterile, but also things that, though they will not touch the wound, may come in contact with something that will, and such things must not only be made sterile, but kept sterile. To do this, until a nurse has had a great deal of practice in preparing, assisting with, and doing surgical dressings, requires constant thought and watchfulness.

Some methods in common use by which instruments, utensils, etc., are made, and kept, fit for use in the dressing of wounds are as follows:

Sterilization and Cleansing of Instruments.—To prepare instruments for use, blunt ones are boiled in a 1 per cent. sodium carbonate solution for five minutes; sharp ones, except knives, for two minutes; knives are sometimes boiled in the same solution for one minute, but, in many hospitals, instead of being boiled they are allowed to stand in alcohol 95 per cent. for at least thirty minutes.

That instruments may be thoroughly sterilized and not injured by sterilization, the following rules are to be observed:

(1) Never put instruments into the sterilizer until the water is boiling.

(2) Put instruments into the sterilizer blunt end foremost.

(3) Open or unclasp scissors and other hinged instruments before putting them in the sterilizer.

(4) Unless the sterilizer tray is provided with a support into which the scalpels and bistouries can be clasped, the points of such instruments must be protected; this is usually done by winding a small piece of absorbent cotton around the blades.

(5) Before sterilizing hypodermic or other hollow needles, remove the wires, lay the needles on a gauze compress, run the wires through the gauze and over the needles to hold them in place; the points of the needles must not be allowed to come in contact with anything solid other than the gauze. If the needles are not to be used at once, wipe the wires with dry sterile gauze and replace them in the needles; disinfect your hands before doing this and hold the needle, at the screw end, with a sterile sponge; do not touch the needle with your fingers.

Care of Instruments after Use.—The proper cleaning of instruments after use is very essential both to preserve them and to ensure their proper sterilization when required for use. Another necessary precaution in the care of instruments is to count them before starting to clean them and again before putting them away, for many instruments are small and easily lost.

The common routine in the care of instruments after use is as follows:

(1) Count the instruments.

(2) Remove all blood and discharge from the instruments by rinsing the latter in cold water. This must be done, because blood and pus contain albumin which is coagulated by heat; consequently, if the

instruments are put into hot water while there is any discharge upon them, the latter becomes hard and it is sometimes difficult to remove it.

(3) Sterilize the instruments.

(4) Scrub them, on a board kept for the purpose, with a cork or a soft nail brush, using hot water and pearline, bon-ami, or whiting.

(5) When the instruments are perfectly clean, rinse them in hot water.

(6) Dry them with a piece of dry gauze or soft muslin. Dry the inside of needles by alternately inserting and removing their wires until the latter are perfectly dry when removed; dry the wire each time before reinserting it.

(7) Unless the knives can be put where it is absolutely certain that nothing will come in contact with their blades, protect the latter by winding absorbent cotton about them.

(8) Count the instruments and put them where they belong.

Sterilization and Cleansing of Syringes.—The method of sterilizing syringes depends upon the material of which they are made. Glass ones, usually, can be boiled. To prepare these for use:

(1) Test them to see that they are in working order. This is very important.

(2) Boil them for five minutes. Put them into the sterilizer while the water is cold, otherwise the glass may be broken.

Syringes that will be ruined by boiling are usually disinfected by filling them with, and submerging them in, a disinfectant and allowing them to remain thus for the length of time that the disinfectant used requires to do its work. See Chapter II.

Syringes are usually cleansed by washing them in: (1) cold water, (2) warm water and soapsuds, (3) warm water.

Care of Exhaust Pumps.—Exhaust pumps, such as are used for exhausting the air in Bier's cups and bottles used for aspiration, are usually ruined in a short time by boiling or by having a disinfectant drawn into them; therefore, the majority of varieties of these pumps cannot be made sterile if the pump is to be kept in good working order for any length of time, and usually it is not necessary that it should be so, if it is kept separate from the sterile articles and worked by a nurse who does not handle sterile things. The outside of an exhaust pump is cleansed, before and after use, by washing it with green soap and water, but the majority of pumps will keep in better order if they are not put into the water nor the water drawn into them, because moisture of any kind causes the washers to shrink.

Sterilization and Cleansing of Solution Basins, Lotion Glasses, and Kidney Basins.—These things are sterilized either by exposure to live steam, by boiling for five minutes, or by keeping them in a disinfectant the length of time required to render them sterile. The precautions mentioned on page 45 regarding the sterilization of glass must be remembered when sterilizing glassware.

These utensils are usually cleansed by washing them with warm water and bon-ami or soap. A kidney basin that has been used as a receptacle for soiled dressings or to catch the discharge from wounds must be either sterilized or disinfected after use, as well as before.

Sterilization and Cleansing of Rubber Tub-

ING.—To sterilize rubber tubing, boil it for five minutes. It should be tied in gauze to prevent it floating. Rubber tubing should not be sterilized at the same time as instruments, because the latter must be boiled in sodium carbonate solution and this ruins the rubber.

To clean rubber tubing, insert a funnel in one end, let warm water run in and over it, wash it in warm water and soapsuds. Dry the tubing by stretching it through the fingers until no water appears at the outlets, then hang it up and allow it to remain thus for some time. When necessary to put the tubing away sterile, keep it in a sterile towel while stretching it and stretch it for a longer time, but do not hang it up.

RUBBER TUBING FOR DRAINAGE.—Small pieces of rubber tubing are often used in septic wounds to afford an open channel for drainage. The method of preparing these for use will be described in Chapter XXIII. Sometimes during a dressing the tube will be removed, and before it is reinserted it must be washed and sterilized. It should be washed in cold water—hold it with forceps while doing this—and then boiled; this can be done while the wound is being irrigated. When a rubber drain is no longer required for a patient, it should be destroyed with the soiled dressings.

TO CLEANSE AND DISINFECT DRESSING RUBBERS.—Dressing rubbers are not, as a rule, disinfected before use, thus they are not sterile and must be covered with a sterile towel if it is necessary to put them anywhere near a wound. After use they are put into a disinfectant—carbolic 1 to 40 or formaldehyd 2 per cent. are often used—and allowed to soak for at least

one hour and then scrubbed with warm—not hot—water and either soap or bon-ami. Stains that cannot be removed with these agents will usually yield to Labarraque's solution, gold dust, or Dutch cleanser, but such things should be resorted to only when absolutely necessary, for if used frequently they will destroy the rubber.

Disinfection, etc., of Rubber Gloves.—There are various methods of disinfecting rubber gloves. In some hospitals they are, when required for use, boiled for five minutes in a saline solution, then immersed and filled with bichlorid 1:3000 and put on. When prepared for use in this way they are, after being used: (1) rinsed in cold water; (2) sterilized by boiling for two minutes in saline solution; (3) washed with warm water and soap; (4) rinsed in warm water and filled with the water in order to see if there are any holes—all those which have holes should be laid aside for repair; (5) dried thoroughly on one side; (6) turned and dried on the other side; (7) dusted on both sides with talcum powder. In some hospitals the gloves are put away sterile and do not require to be boiled before use. In such case, after they are dried, the gloves are folded and encased in a square of thick muslin and sterilized in the autoclave for ten minutes at 15 lbs. pressure. When the gloves are put up in this way a small amount of talcum powder in paper, both of which have been sterilized for thirty minutes, is put in with the gloves.

The Repair of Gloves.—The proper repair of gloves is very important. A glove with a hole should never be worn, not even though the hole be but the size of a pin-point; for, when rubber gloves are worn, the hands perspire and their skin is macerated, and

the bacteria which, in spite of the most careful disinfection of the hands, are always present in the skin come to the surface and can pass through the smallest hole. The usual method of mending gloves is to keep those which are too old to use and to cut pieces from the good parts of these to cement over the holes in gloves that are still fit for use. The patch must be made to adhere firmly, otherwise it will be worse than useless. It facilitates the mending of fingers if smooth finger-shaped pieces of wood are put into them during the process.

Care of Material Used for Surgical Dressings.—The gauze, etc., used for surgical dressings and the gauze sponges are, in the wards, usually kept in glass jars on the dressing-carriage. These jars are washed and disinfected daily but, as the jar is opened constantly during the day and the disinfection is often very inadequate, it is well to have the dressings done up in small packages with only a few compresses or sponges, etc., in each bundle, and the nurse who puts these into jars should disinfect her hands before she takes the bundles from the sterilizer or drum and loosen the wrappings of the packages enough to make it easy to open them later with forceps and then put the bundles into the jars. This does not look as well as having the gauze and sponges loose in the jar, but it is more aseptic. Dressings not used within twenty-four hours should be resterilized. Compresses, sponges, etc., should be always taken from the jar with long, sterile forceps—*even after you have disinfected your hands, do not put them into a jar containing sterile supplies*. The methods of preparing supplies for surgical dressings will be found in Chapter XXIII.

Disinfection of the Hands.—In the glands and

creases of the skin and under the nails there are innumerable bacteria, and, as the hands cannot be subjected to a sufficiently high temperature nor immersed in solution long enough to kill germs, they are never really sterile. Therefore rubber gloves are now nearly always worn when it is necessary to have the hands sterile. The usual method of disinfecting the hands for preparing or doing dressings is as follows: The hands and forearms are vigorously scrubbed with green soap and hot water for three minutes, using a sterile brush. The water should be hot, as this will cause sweating and bring some of the bacteria to the surface; also, if possible, for the last part of the washing the water should be flowing from the faucet, as this will help to wash away the bacteria. Next, the finger nails are cleaned, even though they appear clean, with a sterile blunt-pointed orange stick, and then scrubbed with bichlorid of mercury solution, 1:1000, for two minutes. If the gloves are put on wet, the hands need not be dried, but if the gloves are dry they can be drawn on more easily if the hands are dried. The towel used for the purpose must be sterile.

If gloves are not worn, the hands should be scrubbed for five minutes. Unless the hands are kept soft and free from cuts and roughness, it will be a very difficult matter to make them even comparatively sterile, therefore the advice given in Chapter I regarding the care of the hands, and that in Chapter II concerning the use of bichlorid and soap, page 49, should be followed.

Disinfection of Nail Brushes and Orange Sticks.—Nail brushes and orange sticks that are to be used when disinfecting the hands should be boiled

for five minutes daily and kept in a disinfectant. Carbolic 1 : 40 is very generally used.

Precautions that are Necessary in Order to Keep Things that have been Sterilized Sterile. —If a nurse exercises proper care and thought in the early days of her training, the carrying out of aseptic technique will become a fixed habit, but, as already stated, until a nurse has had considerable practice and experience in surgical work, it requires constant thought and watchfulness not to do anything which will make dressings, etc., unsterile. Some of the important blunders that it is necessary to guard against are: Pouring out solutions or lotions without first washing off the rim of the bottle with a disinfectant; placing stoppers and covers inner side downward on an unsterile table; letting sterile dressings, instruments, etc., come in contact with unsterile objects; touching unsterile things with the hands after they have been disinfected. When necessary to take hold of any unsterile object, after the hands have been disinfected, use a pair of sterile forceps or a sterile towel. If necessary to use the latter more than once, be sure not to touch the side which has been made unsterile.

Nature and Preparation of Dressings

Dressings are of three kinds, occlusive, absorptive, and disinfectant. The occlusive dressing most generally used is collodion, either alone or with a small piece of gauze or cotton. Such dressings are used only for wounds from which there is not likely to be any discharge of serum or other fluid. The usual absorptive dressing consists of sterile gauze and, when there

is a great deal of discharge, sterile absorbent cotton. Such dressing should never be covered with anything that will prevent free evaporation of the fluid discharged from the wound. Disinfectant dressings are absorptive also. They consist of such things as iodoform gauze, or of gauze wet in a disinfectant solution such as alcohol, bichlorid of mercury, aluminum acetate. Such dressings must not be covered with an impervious material for, if they are, the skin becomes macerated and conditions which favor germ development provided—*i. e.*, warmth and moisture. Occasionally carbolic acid solution is used, because of its anesthetic effect, for the relief of pain due to inflammation. When it is, the patient must be carefully watched or gangrene of the tissues may result. The first symptoms of an untoward effect are a sensation of burning and local anemia of the skin, if the drug is not then discontinued, the skin will soon present a blistered appearance. The danger attending the use of carbolic for this purpose is so great that it is now rarely used. Balsam of Peru and other disinfectant drugs, that are vascular stimulants and will, consequently, accelerate tissue growth, are put into wounds, either alone or on gauze, when the granulation process is sluggish. Nitrate of silver, copper sulphate, and other caustic drugs are used to remove exuberant granulating tissue; they also improve the circulation of blood in the part and consequently the character of the granulations which replace those removed. Sterile antiseptic powders and ointments are occasionally used on granulating wounds for their drying or emollient properties. Peroxide of hydrogen and normal salt solution are very generally used for the washing out of suppurating wounds; their action was discussed in Chapter II.

Drains are usually put into wounds where there is likely to be discharge of any kind. Such drains are usually made of either gauze, lamp-wicking, rubber tissue, or rubber tubing. Sometimes the gauze or lamp-wicking is rolled in the rubber tissue; such drains are known as *cigarette drains*. Methods of making and sterilizing drains will be discussed in the chapter dealing with operating-room technique, page 606.

Instruments Needed for Dressings.—For the dressing of a closed aseptic wound a pair of long forceps to take gauze, etc., from the jars and a pair of thumb forceps are usually all that is required. For open wounds there are generally needed, in addition to the forceps, a pair of scissors and, sometimes, a probe. If the wound is discharging, a syringe or an irrigator and irrigating tip, or both, may be required, the syringe for peroxide of hydrogen, and the irrigator for saline or other solution.

Peroxide of hydrogen should be poured into a small glass or other small receptacle; only a small quantity, about one half to one ounce, will be needed. It must not be poured out until it is wanted, because when exposed to air and light it is easily decomposed and the oxygen, upon which its therapeutic action depends, lost.

Arrangement of Utensils, etc., on the Dressing-Carriage.—The gauze, sponges, instruments, etc., used for surgical dressings are generally kept on a dressing-carriage, which, unless there is a room to which the patients are taken to have their dressings done, is wheeled from bed to bed. The principal points about the arrangement of the contents of the carriage are: (1) to keep the sterile and unsterile things apart

from each other; (2) to have special places for each and every article, and always to put everything in its place; (3) to put things near each other that will

Fig. 85. Dressing-Carriage.

be needed at or about the same time; (4) to leave a vacant space among the unsterile objects in which to put solution basins, etc., after they have been used. Fig. 85 shows a dressing-carriage on one side of which are two large metal boxes, and a metal slab

divides these boxes from the rest of the carriage, because one is used to hold a paper bag into which the soiled dressings will be put when taken from wounds, and the other one, a bag for dressing towels that have been used. After "dressings" are over, these bags are removed and replaced by clean ones.

Liquids or powders in small bottles that are likely to be needed during dressings—*e. g.*, peroxide of hydrogen, balsam of Peru, alcohol—are kept on the top shelf of the carriage but, otherwise, this is reserved for sterile articles.

Preparation of the Carriage for Use.—When a number of dressings are to be done, as many solution basins and lotion glasses as will be required are sterilized and piled between the folds of a sterile towel upon the top shelf of the carriage. The instruments likely to be needed are sterilized and placed in the instrument tray between the folds of a sterile towel; a sterile dish, with a pad of gauze in the bottom, is placed on the top shelf to receive the instruments after they have been used; this dish is sterilized, because it is usually more convenient to have it on the top shelf and, if there, it is likely to come in contact with something sterile. The irrigator and kidney basins are, after being sterilized, wrapped in sterile towels; they are usually kept until required on the lower shelf of the carriage. All the bandages, binders, adhesive plaster, dressing rubbers, Kelly pad, bottles of solutions, and all unsterile articles likely to be required are placed on the lower shelf, and a vacant space is left on this shelf in which to put solution basins and the like after they have been used. Solutions used for irrigation and for moistening sponges in should be between 100° and 105° F. when used;

therefore it is well to have both hot and cold solutions on hand.

To Prepare a Dressing on a Tray.—Sometimes it is necessary to take a dressing to a patient's room on a tray, instead of a dressing-carriage. To prepare this, unless the tray can be sterilized by boiling, scrub it with soap and warm water, dry it with a *clean* towel, and cover it with a sterile towel. Place the sterile articles on this and cover them with a sterile towel.

Assisting with Dressings.—The assistance wanted of a nurse for dressings depends very largely upon the nature of the dressing. For simple dressings, the nurse's duties usually consist in getting the patient ready, placing the dressing-carriage in position, lifting the covers from jars that the doctor may get gauze, sponges, etc., pouring out solutions and the like, and putting on the bandage or binder. When this is all the nurse is expected to do, it will not be necessary for her to touch anything sterile; she should, nevertheless, disinfect her hands as described on page 541.

In many hospitals, it is customary for two nurses to assist with dressings, one getting the patients ready and doing the bandaging or putting on the binder as each dressing is finished, and the other assisting the doctor. In such case, it is possible for the latter to keep her hands sterile, for she can use a sterile towel or gauze to lift covers, etc.

The majority of doctors have certain routine methods of doing dressings, and nurses should remember just what each one with whom she has to work wants and how he likes things done.

Preparation of a Patient for a Surgical Dressing.—For an abdominal dressing in which

irrigation will not be required: Fold back the bedclothes so as to expose the patient's abdomen, but not the pubes—there must be but one fold of the clothes and that perfectly smooth. If the ward or room is cold, put a nightingale or folded blanket across the patient's chest, turn up the tail of her nightgown above the abdomen, open the binder, and cut or loosen the adhesive plaster (see page 550). Remove the outer layer of dressing—unless there is but one layer; this can be done without touching the dressing, lifting it by the adhesive plaster or, if it is customary for the nurse whose hands are sterile to remove it, with a pair of sterile forceps. It is a common custom to keep a pair of sterilized forceps in a test tube containing 95 per cent. alcohol to use for such purposes. The inner layer of dressing is removed by the doctor with sterile forceps. The dressing is put into the paper bag provided for it immediately upon its removal. The removal of dressings will be further discussed on page 551. After the *outer* layer of dressing has been taken off, a sterile dressing towel is put over and around the fold of bedclothes at their line of contact with the abdomen. In some hospitals this is, under ordinary circumstances, the only towel used; in others, the wound is surrounded by towels. Sometimes the doctor arranges the towels, but if he wishes the nurse to do it, she should take the towels, one at a time, if more than one is used, from the jar with sterile forceps, and in opening and getting a towel into position touch it at the corners only.

If the wound is to be irrigated, the patient is drawn to one side of the bed before the binder is opened, and a rubber covered with a dressing towel put under her

or, if a large quantity of solution is to be used for the irrigation, a Kelly pad or else both a Kelly pad and rubber, the latter under the former. In such case, the upper bedclothes also will need to be protected with a rubber. This is put around the fold of clothes before the sterile towel is put in place. If a Kelly pad is used, its free end is put into a pail; if only a rubber is necessary, the nurse will hold a kidney basin in position to receive the flow, as soon as the doctor is ready to irrigate.

Whatever the location of the wound, the essentials of the preparation of the patient for a dressing are about the same. The principal things to remember are:

Make the patient as comfortable as possible.

Expose the wound and for a few inches around it, but no more.

Cover anything unsterile that is likely to come in contact with the wound or sterile dressings with a sterile towel.

If the wound is to be irrigated, protect the bed.

Removal and Putting on of Adhesive Plaster.—When the removal of the adhesive plaster annoys the patient, it need not be pulled off the skin at each dressing, but it can be cut, on either side, at the edge of the gauze and the new piece stuck on over that left attached to the skin. When removing adhesive plaster, pull it off quickly, for this hurts less than when it is removed slowly, and pull it, on both sides of the dressing, toward the wound. Unless the skin is abraded, remove the material left by the adhesive plaster with either benzine or alcohol; if there are any abrasions, use hot water. Never put a strap where the skin has been abraded by a former one.

Order of PROCEDURE IN THE DRESSING OF WOUNDS.—When a nurse does the dressing, the order of procedure is about as follows:

Bring everything required to the bedside.

Arrange the bedclothes so as to expose the dressing.

If irrigation is to be used, protect the bed and make any other arrangements for the irrigation that will necessitate touching unsterile articles.

Remove the bandage or binder and the outer layer of dressing, if there are several layers

Disinfect your hands.

Arrange the sterile towel or towels in position.

Remove the gauze covering the wound with a pair of sterile forceps. Do this in the direction of the long axis of the wound or else from each side toward the wound, so that if the gauze is adherent it will not pull the edges of the wound apart. If the wound is sutured, be careful not to pull the stitches. If the gauze does not come off readily, moisten it with salt solution; this can be done with a small syringe or by squeezing the solution from a sponge.

Proceed with the dressing, observing the following precautions:

Use forceps whenever possible rather than the fingers. Do not use the same pair of forceps to touch the fresh dressings as you use for removing the soiled one.

Sterile wounds are to be kept dry; do not try to remove any dried blood that may be over the wound until the latter is healed. The blood is nature's method of closing the wound.

Unless there is discharge to be wiped away, do not touch the wound with anything other than the gauze

that is to cover it. The dressing of a closed, aseptic wound usually consists of the removal of the dressing and application of one or two pieces of fresh sterile gauze.

If there is discharge around the wound, wipe it off with sterile sponges; hold these in forceps, not the fingers; always wipe away from the wound so as to avoid getting anything into it, but hold its edges in apposition while wiping, to prevent breaking any of the new tissue and thus retarding the healing process.

Do not squeeze an abscess or suppurating wound; doing so forces the infection through the adjacent tissues.

Do not pull off sloughing tissue forcibly. Irrigate the wound with (1) peroxide of hydrogen, (2) salt solution, and then, with a sponge held by forceps, or with the latter alone, remove any sloughs that have been freed but not washed out.

When using nitrate of silver or other caustic to remove exuberant granulations, be careful to touch the granulations only and not the edges of the wound or skin.

If a wound has been irrigated, absorb the moisture with sponges, but do not rub the wound, before applying the caustic, otherwise the latter may be washed over the skin.

Do not put enough packing into a wound to interfere with drainage. The purposes of a packing are to facilitate drainage and to keep the wound open until suppuration ceases.

When discharge from a wound irritates the skin, the latter is often covered with sterile boric acid ointment.

Always notice, report, and record any abnormal

condition in a wound, but a nurse has no more right to make any alteration in a dressing without an order from the surgeon than to give the patient a medicine that was not prescribed by him.

Adhesive plaster is generally used to keep the dressing in place and the sides of the wound in apposition, as this obviates the necessity of putting on the bandage or binder tightly, and usually, where there are wounds, this should be avoided, since a tight bandage impedes the circulation in the wounded part. Exception to this rule is made when support is needed—*e. g.*, where there are ulcers due to varicose veins.

Always dress aseptic, before suppurating, wounds.

Always reinforce a dressing, as soon as discharge comes through to the surface. Not only does the soiled dressing look untidy, but the gauze is no longer impervious to germs and the discharge affords a culture media for any bacteria that fall upon it.

Technique of Removing Skin Sutures.—Occasionally, a nurse is told to remove superficial sutures. To do this, grasp one end of the suture with sterile forceps and make gentle traction upon it, until it is raised about a quarter of an inch from the skin; cut it with a pair of sterile scissors on the side of the forceps farthest from the suture knot; continue making traction upon the suture until it comes out. The traction must be made in the direction of the long axis of the wound.

CHAPTER XXII

TREATMENTS WHICH REQUIRE ASEPTIC PRECAUTIONS

Acupuncture. Aspiration of Abdomen, Thorax, and Pericardium. Exploration. Lumbar Puncture. Intravenous Infusion. Hypodermoclysis. Transfusion of Blood. Vaccination and Injection of Antitoxins. Differences between Vaccines and Antitoxins. Methods of Obtaining Blood for Examination. Intubation.

THE following treatments which are, practically, minor operations, are done by a physician or surgeon; therefore the only details of procedures given here, other than the preparation of the patient and the required utensils, are such as will give the nurse sufficient knowledge of the nature of the treatments to enable her to give the assistance required of her.

Preparation of Utensils and Instruments.—It is of the utmost importance that instruments and all utensils that will come near things that should be sterile are made perfectly clean and aseptic. The way in which the various instruments, etc., should be prepared for use was described in the preceding chapter. Usually, the sterile requisites are taken to the patient's bedside on a tray. This tray should be either sterilized by boiling or else scrubbed with soap and hot water (even though it appear quite clean) and covered with a sterile towel. The sterile articles are laid upon this and covered with a second sterile

towel; the latter must be put on so that it will really protect the things underneath it from the air or any other unsterile matter.

Preparation of the Patient's Skin.—The patient's skin at the area of operation must be rendered as sterile as possible previous to any of these treatments. The cleansing is usually done by a nurse a short time before the hour set for the treatment. In some hospitals, the preparation consists of painting the skin over and around the part to be worked upon with iodine and then covering it with sterile gauze. Usually the skin is not washed with soap and water when iodine is to be used unless it can be done some hours beforehand, because they interfere with the action of the iodine. In other hospitals, the skin is scrubbed with: (1) hot water and green soap; (2) ether; (3) alcohol, 70 per cent., or other disinfectant, using a sterile nail brush or sterile gauze sponges, and after the skin has been thus cleansed it is covered with gauze wet with bichlorid of mercury 1 : 2000, which remains on until the doctor is ready.

The reason for the use of these various cleansing and disinfectant agents was given in Chapter XX in connection with the local preparation of a patient for operation.

Acupuncture

Nature.—This consists in the insertion of hypodermic needles, or other small sharp instruments into the superficial tissues for the purpose of withdrawing fluid from edematous areas.

Technique.—Before the needles are inserted, the skin is disinfected as previously described and a

rubber covered with a sterile dressing towel is placed under the part in which the punctures are to be made. After the doctor has inserted the needles, a bed cradle is put over the part to prevent the bedclothes pressing upon it. The needles are usually left in for several hours. When they are removed, the skin is washed with sterile water, dried with a sterile towel, and sterile gauze bandaged about the part. Several thicknesses of gauze are necessary as there may be quite a profuse oozing of serum.

Aspiration

Definition.—Aspiration is the withdrawing of liquid or gas from a cavity.

Abdominal Aspiration

Abdominal aspiration or the withdrawing of fluid from the peritoneal cavity is known as *paracentesis*, and *ascites* is the name used for the condition in which there is such a collection.

Instruments Required for Abdominal Aspiration.—These are:

Canula and trocar (the canula is a small silver tube and the trocar a sharp-pointed steel rod which fits into and extends beyond the canula).

Scalpel
Probe
Scissors
2 Needles
Forceps.

There will be also needed:

12 sterile sponges

A dressing consisting of two large compresses of sterile gauze and two pieccs of sterile absorbent cotton.

Sterile suturing silk

2 sterile towels

Adhesive plaster

A binder—preferably a scultetus.

A sterile funnel with a long piece of rubber tubing connected to it. This is intended to convey thc fluid from the canula to a jar standing on the floor. Some canulas have a projection to which the rubber tubing can be fitted and when this is the case the funnel will not be required; sometimes the receptacle for the fluid is held under the spout of the canula and both tubing and funnel are dispensed with.

A pail to catch the liquid or, if the latter is wanted in the laboratory for culture media, sterile five-pint bottles.

Two rubber sheets, one to protect the floor and the other the bedclothcs.

Sterile glasses containing the disinfectants necessary for disinfecting the skin.

Stimulants as ordered—stimulation should be near at hand, for it is often required unexpectedly.

Hypodermic syringe ready for use and loaded with cocain.

Laparotomy stockings.

Extra pillows and two muslin bandages or else a back-rest such as described on page 558.

Two stools, unless the bed is low enough for the patient's feet to rest upon the floor.

A board to put across the bed under the mattress.

Two blankets—only one will be required if the patient does not sit up.

Preparation of the Patient.—In addition to the preparation of the skin mentioned on page 555, it may be necessary to shave the abdomen where the puncture is to be made. The patient must void urine just before the operation is performed; this is very important, for if the bladder is distended it may be punctured by the trocar. Some doctors require patients to be catheterized. If the patient is to sit up on the edge of the bed, as is nearly always done unless she is too weak, laparotomy stockings are put on and she sits near the head of the bed with her legs over the side. She must be placed on the extreme edge, and a board is to be put across the bed under the springs; this is to prevent the mattress sagging, and is necessary, because if the patient sinks into the hollow, drainage will be interfered with. One blanket is put around the patient's body; later this is pinned up so as to expose the abdomen. The other blanket is wrapped about the patient's legs; this is covered in front with a rubber. A stool is put under each foot. A firm support must be provided for the patient's back. In some hospitals special back-rests are provided; these consist of a light metal frame covered with canvas, which extends beyond the bottom of the frame and can be laced to the bar at the side of the bed on which the patient is sitting. When a back-rest is not used, a sufficient number of pillows to reach to the patient's head must be placed at her back, and to keep the pillows in place a bandage is passed around them at either end and tied both at the edge of the pillows and to the bar at the side of the bed on which the patient is sitting. Stirrups, for the patient to rest her feet in, can be made of the free end of the bandage, if no stools can be had and the bed is

too high for the patient to rest her feet upon the floor.

The binder is placed behind the patient's back, for it is often necessary to pull one or both of its ends forward during the operation in order to make pressure against the sides of the abdomen and thus facilitate the draining of the liquid through the tube.

If the patient is unable to sit up, draw her over to the edge of the bed, put a dressing rubber covered with a towel under her, turn her on her side; place pillows against her back; cover her trunk, except the abdomen, with a blanket; fold down the bedclothes to below the abdomen, put a dressing rubber over the clothes where they come in contact with the abdomen.

When the doctor is ready, the abdomen is surrounded with sterile towels.

The operation consists in the making of a small incision, inserting the trocar and canula into the wound and withdrawing the trocar, whereupon the liquid that has accumulated in the peritoneal cavity flows through the canula and rubber tubing into the receptacle provided to receive it.

There may be very copious drainage after the operation, therefore the dressing must be watched and changed whenever necessary. The dressing should not be covered with any impervious material, for if evaporation of the discharge is prevented the patient's skin may become very much irritated.

Aspiration of the Thorax

Causes of Collection of Fluid.—An excess amount of fluid may collect in the pleural cavity from

various causes; some of the more common are · transudation of fluid from the blood-vessels on account of abnormal changes in the blood-pressure, feeble circulation, inflammation of the pleura also; in the latter case, the secretory cells of the pleura produce more secretion than can be absorbed, as is the case when there is only a sufficient amount secreted to keep the walls of the pleura lubricated. When there is such a collection of fluid in the pleural cavity, the condition is known as *hydrothorax*, unless the fluid is pus, when it is known as *empyema*.

Articles Required for Aspiration of the Thorax.—The sterile requisites are:

The Aspirating Apparatus.—This consists of a graduated glass bottle with a rubber stopper in which there is a hollow metallic tube with two branches at the top; two rubber tubes with metallic ends which fit the branches of the metallic tube in the stopper; an exhaust pump; a needle.

A hypodermic syringe loaded with cocain 2 per cent.

Twelve gauze sponges.

Two towels.

Collodion and sterile swab if the puncture is to be protected with collodion, otherwise a gauze compress and adhesive plaster.

Glasses containing the disinfectants for disinfecting the skin.

A solution basin containing sterile water for the testing of the apparatus.

The unsterile requisites are:

Stimulants.

A dressing rubber.

A kidney basin.

A tray.

A small blanket, or nightingale, to protect that point of the chest not to be exposed.

Fig. 86. *Aspirating Apparatus*

PREPARATION OF UTENSILS FOR USE.—After collecting all the requisites and sterilizing those required to be sterile, disinfect your hands, put the cork in the bottle, attach the two pieces of rubber tubing to the metal tubes in the cork, and test the apparatus to make sure that it is in working order. The majority of exhaust pumps used for the purpose of exhausting the air in the bottle have two projections. On each of these points there is an arrow, and each arrow points in an opposite direction. Insert the projection on which the arrow points upward into one of the pieces of tubing and then proceed as follows: Open the stopcock in the metal

tubing, on the side to which the pump has been attached, and close the one on the opposite end. Exhaust the air in the bottle by pumping until the pump grows hard to work. It must be remembered that the air pumped out will not be sterile. The pump must therefore be pointed away from the table. Put the end of the other tubing (in which the needle is to be inserted when ready for use) into the sterile water and reverse the order of the stopcocks. If the apparatus is in working order, the water will immediately start to flow through the tubing into the bottle. Do not attach the needle until the doctor is ready to use it, and in the meantime the wire must be kept in it.

Preparation of the Patient.—The skin is cleansed and disinfected as usual. The patient generally sits up in bed or, if too weak, is propped up with pillows in a semi-sitting position; the night-gown is removed from the arm of the affected side and the gown and a nightingale arranged so that the other side of the chest and back will be covered. Sterile towels are disposed around where the puncture is to be made. While the doctor is doing this, the nurse usually creates a vacuum in the bottle by means of the pump in the same way as when testing the apparatus. The doctor then inserts the needle into the pleural cavity, changes the stopcocks, and the fluid should then flow from the chest into the bottle. Generally the fluid is not all withdrawn, because, if it were, the irritated surfaces of the pleura would rub together during respiration and cause pain and coughing. After the needle is withdrawn, the puncture hole is covered with a small piece of sterile gauze and collodion, or a small gauze compress and adhesive plaster.

Aspiration of the Pericardium

Occasionally, in the course of some diseases of the heart, liquid collects in the pericardial sac,—*i. e.*, the sac formed by the pericardium, the membrane covering and surrounding the heart. This fluid may be removed either with the aspirating apparatus or with what is commonly known as an exploring syringe. This resembles a hypodermic syringe, but is much larger. The exploring syringe is used more frequently than the larger apparatus, because the pericardial sac being small there is never a large quantity of fluid.

If the aspirating apparatus is used, the same articles will be required as for aspiration of the thorax.

If the exploring syringe is used, the sterile requisites will be:

The syringe and needles (at least two are prepared).

Two towels.

Sponges.

A hypodermic syringe loaded with cocain 2 per cent.

The disinfectants required for disinfection of the skin.

A test tube or glass to receive the liquid drawn from the cavity.

Collodion and a sterile swab or else a gauze compress and adhesive plaster.

The same unsterile articles and the same preparation of the patient are required as for aspiration of the thorax.

Exploration

When the presence of serous fluid or pus in the

pleural cavity is suspected, examination is somctimes made by aspirating with the same kind of a syringe as that used for aspiration of the pericardium. The same articles and the same preparation of the patient will be needed as for that operation.

Lumbar Puncture

Nature of.—Lumbar puncture is aspiration of the spinal canal. It consists in the insertion of a long hollow needle through the back, between the vertebræ, into the spinal canal for the purpose of removing excess cerebro-spinal fluid.

Source of Excess Fluid.—The membrane covering the brain and spinal cord and lining the brain, skull, and spinal canal is of the same nature as the pleura and the peritoneum; also it serves the same purpose—*i. e.*, the secretion of a serous fluid that lubricates the surfaces of the membrane and thus prevents friction. Irritation of this membrane will produce an excessive secretion and also inflammation with consequent transudation of serum from the blood-vessels.

Reason for Lumbar Puncture.—Inflammation of the meninges is known as *meningitis*, and the symptoms that occur during the disease are due, in part, to pressure of the excess liquid on the brain. Therefore lumbar puncture is performed for two purposes: (1) to ascertain if the symptoms are due to meningitis, (2) to relieve the symptoms.

Necessary Instruments and Utensils.—These are the same as for aspiration of the pericardium.

Position and Preparation of Patient.—The patient is placed on the edge of a table or bed with her knees drawn up toward her chest and her shoulders

curved toward her knees. This position is used, because when the patient is so placed the laminæ of the vertebræ are separated and the entrance of the needle thus facilitated. The skin at and around the point of puncture is disinfected as for aspiration. The puncture is usually made at the lower end of the spine between the fourth and fifth lumbar vertebræ, since the liquid and bacteria, if they are present, tend to gravitate to this portion of the neural sac.

Hypodermoclysis and Intravenous Infusion

Nature of Treatments.—Hypodermoclysis is the injection of fluid—usually normal salt solution—into the tissues, and intravenous infusion is its introduction into a vein.

Purposes of these Treatments.—Fluid is introduced into the system in both these ways for the same purposes as when it is given as an enteroclysis and protoclysis, see pages 368 and 370. Intravenous infusion is rarely used except in emergency, because there is considerable danger attending the introduction of fluid into a vein, and the operation is nearly always followed by a reactionary chill. The stimulating effect of the infusion upon the heart, however, is likely to be almost instantaneous, and therefore it is frequently resorted to when a patient is suffering from severe shock. A hypodermoclysis is given in preference to the rectal injections when for any reason it is not advisable to give the fluid by rectum and when a more immediate result is wanted, for, though the results of the hypodermoclysis are not as instantaneous as those of the intravenous infusion, they are more rapid than when the fluid is given by rectum. Either of these two methods is used to supply the

body with fluid after hemorrhage; the clysis being used in preference to the infusion when there is any danger of the sudden stimulation of the heart's action causing the hemorrhage to begin again. Some of the good results expected to follow the introduction of the salt solution into the body after hemorrhage are: The circulating blood is brought to a sufficient quantity to maintain normal conditions of pressure in the blood-vessels, and the heart action is slowed and strengthened because the heart is forced to make stronger contractions in order to propel the extra fluid through the blood-vessels; injury to the tissues from loss of fluid is prevented, and the red corpuscles that remain in the vessels are kept in circulation so that the loss of oxygen to the tissues is thus lessened until new corpuscles have been made.

Dangers Attending the Giving of Intravenous Infusion and Necessary Precautions.—As stated on page 523, injury to a vein or the entrance of any foreign substance into it is likely to cause a thrombus and embolism and consequent death of the patient. Naturally, when a vein is opened and fluid injected into it only the greatest care can prevent such an accident happening. The nurse's share in the necessary precaution consists in a careful attention to every detail of the sterilization. Bacteria are about the most dangerous of all possible foreign substances to introduce into a vein; also, it is generally considered the nurse's duty to notify the doctor before the salt solution becomes so low in the reservoir that air could pass into the tubing and so on into the patient's vein. Another danger attending the use of intravenous infusion is that, unless the salt solution is of the right per cent., hemolysis—*i. e.*, disintegration of the red

blood corpuscles—will follow. This is because if a liquid of lower specific gravity than the blood-serum is introduced into the blood it will enter the corpuscles and cause them to swell and rupture and, if the solution is more concentrated than the blood serum, liquid will be extracted from the corpuscles and consequently they will become shriveled.

Why Salt Solution is Used for Intravenous Infusion.—As can be readily appreciated from what has been already said, there are very few substances that can be introduced into a vein without causing harm, but as sodium chlorid is one of the important constituents of the blood, it will, if used between $\frac{6}{10}$ and $\frac{9}{10}$ per cent., do no harm. The salt of itself is not a stimulant, the stimulation that follows an infusion being due entirely to the effect of the extra amount of fluid in circulation and to the heat.

Articles Required for an Intravenous Infusion.—These are:

One aneurism needle.

Two artery clamps.

Two canulas with wires—different sizes.

Two pieces of tubing. One piece should be long enough to reach from the reservoir containing the solution (when placed three feet above the bed) to the patient's arm. The other piece need be only four or five inches long. This is joined to the longer piece by means of a glass connecting tube. The tubing is connected in this way so that it may be seen in the glass tube if there are any bubbles in the fluid—bubbles are due to the presence of air.

Two glass connecting tubes.

A tube carrier—if a flask is used as a reservoir for the solution.

Two pair of mouse-tooth forceps.
One pair of thumb forceps.
One probe.
One pair of scissors.
One scalpel.
Two surgeon's needles.
One thermometer.
One glass syringe.
One hypodermic loaded with cocain, 2 per cent.
Catgut.
Suture silk.
Three sterile towels.
Bandage—sterile.
Gauze compress for dressing.
Twelve gauze sponges.
Sterile glasses containing the solutions necessary for disinfecting the skin.
Kidney basin.
Dressing rubber.
One flask of cold salt solution.

Two flasks of salt solution 124° F. The solution is not used at a temperature above 120° F., but it is necessary to prepare it hotter, for some time may elapse before the doctor will be ready to use it and, if necessary, the temperature can be easily lowered by the addition of some cold solution. The thermometer is left in the reservoir during the giving of the infusion, and some hot solution is added should that in the reservoir become cooled.

In some hospitals an irrigator is used, the solution being poured into it from the flask in which it is sterilized. In other hospitals the solution is left in the flask in which it is sterilized, and siphoned from it by the following arrangement: A glass connecting tube

is inserted in one end of the rubber tubing in order to weight it; this is put into the flask, the free end of the connecting tube being less than $\frac{1}{8}$ of an inch from the bottom of the flask. The tube carrier is placed over the rim of the bottle and the tubing placed in it. This carrier is a small metal trough that fits over the rim of the flask. Its purpose is to prevent the tubing becoming bent on the rim. The doctor starts siphonage when he is ready, either by inserting the point of the syringe in the free end of the tubing and drawing the piston, or by drawing the tubing through his fingers. The canula is then inserted in the free end of the tubing.

With the exception of the dressing rubber all the articles mentioned must be sterile.

Another very important requirement for the giving of an infusion is a good light; therefore an electric or other lamp should be provided, even in the daytime, if the light is not good.

Preparation of the Patient.—Either the median cephalic or the median basilic vein at the bend of the elbow is usually selected and the arm and forearm for several inches from this point must be cleansed and disinfected. A dressing rubber covered with a sterile towel is passed under the arm; the part of the arm and forearm not disinfected and the hand are covered with sterile towels; a bandage is placed around the upper part of the arm tightly enough to obstruct the return flow through the superficial veins and thus cause the veins in the elbow bend to become prominent. This bandage is cut after the canula has been inserted in the vein and the nurse is often expected to do this.

Nature of Operation.—The skin above the vein is incised for about an inch and the vein freed from

all attachment for the space of half an inch. Two ligatures are passed around the vein, one above and the other below the point of intended opening. The ligature at the distal end of the incision is tied, a small opening made in the vein into which the canula, after some solution has been allowed to run through it in order to guard against the entrance of air, is passed; the upper ligature is then tied around vein and canula, the bandage around the arm is cut, and the solution allowed to flow into the vein.

Another method of giving an intravenous infusion is to use a needle instead of a canula and to insert this through the skin into a vein without making an incision. The arsenic preparation variously known as *dioxydiamido-arsenobenzol*, *salvarsan*, and "*606*" is frequently given in this way.

The patient is prepared for the infusion in the same way as when an incision is made, and the same precautions against infection and the admission of air into the vein must be taken. Also, the same articles will be required, with the following exceptions: No instruments, suture silk, or catgut will be needed; an aspirating needle will be used instead of a canula.

Articles Required for Giving a Hypodermoclysis.—These are:

Two aspirating needles with wires or, if it is desired to have the solution enter the tissues slowly, a large hypodermic needle.

A tube carrier.

One piece of rubber tubing about 50 inches long and one about 12 inches, if only one needle is used, or two, if two needles are used.

A T-shaped glass connecting tube, if two needles are used (this is used to connect the three pieces of

rubber), or two straight connecting tubes if one needle is used. One of these glass tubes is used to connect the short to the long piece of tube, such connection being made, as already stated, so that it can be seen if any air enters the tube. The other glass tube is inserted in the end of the rubber tubing that is put into the flask; it will not be needed if an irrigator is used.

Thermometer.

Glass syringe.

Hypodermic loaded with cocain 2 per cent.

Sterile towels, 2.

Gauze sponges, 2.

Either collodion and sterile swab or else a gauze compress and adhesive plaster.

Sterile glasses containing the disinfectants for the skin.

A kidney basin.

One flask of cold salt solution.

Two flasks of salt solution about 115° F. The temperature at which the solution is generally used is between 110° and 112° F. If it is this temperature in the flasks it will be about 105° F. when it enters the tissues.

All these articles must be sterile.

Locations for Injections and Preparation of Skin.—The usual situations selected for injections are: Just below the breasts, the sides of the abdomen, or the external surfaces of the thighs. The skin is disinfected in the same manner as it is for aspirations.

Preparation of the Apparatus.—Sterilize, and, with sterile hands, insert the stem of the T-tube in the long piece of rubber tubing, and each arm in a short piece. Fit the glass tube intended to act as a weight

in the free end of the long tube, and a needle in each of the short pieces. Slip the end of tubing which is to go into the flask into the carrier at the point where it will go over the rim of the flask, arranging it so the tip of the glass tube just escapes the bottom of the flask. Do not put the tubing into the flask until the doctor is ready to use it; he then generally does so himself, and starts the liquid flowing, either by ex-

Fig. 87. Continuous Clysis

pressing the air by drawing the tubing between his fingers, or by suction obtained by disconnecting the main tubing from the T, inserting the nozzle of the syringe in it, and slowly drawing up the piston when the flow is started; reconnecting the tubing and allowing the fluid to flow through the needles to expel all air, after which he inserts them in the tissue. When given in this way it takes about one-half hour for a liter of solution to enter the tissues.

Sometimes a larger quantity of solution is given. In such case, it is given very slowly and means must

be taken to keep the solution hot. One of the easiest ways of doing this is to support the flask on an iron stand such as is used in any chemical or pathological laboratory, and to keep a lighted Bunsen burner under but at some distance from it. Usually only a very small flame is required; a thermometer must be kept in the solution and it must be looked at frequently.

Transfusion

By transfusion is meant the transfer of blood from one person to another. This operation is seldom performed except as a last resource, because it is attended with great danger mainly for two reasons: (1) the operation is conducive to clotting of the blood and consequent embolism, (2) the blood of the donor may not be of the same specific gravity as that of the recipient, and in such case hemolysis, or disintegration of the blood corpuscles, is likely to follow.

Nature of Operation.—The blood is usually taken from the donor's radial artery at the wrist and passed directly into one of the large veins on the inner surface of the recipient's elbow. For convenience' sake, the same arm on each patient is prepared and the beds or tables on which the patients are lying placed with the foot of one facing the head of the other. If the patients are on beds, the latter must be placed far enough apart for a small table to be placed between the beds, to afford a support for the patients' arms. If tables are used instead of beds, these are placed apart until the incisions are made and then drawn together.

The veins of donor and recipient are either united directly by some form of silk sutures, or by means of

specially constructed canulas. The vessels are kept moist during the operation with warm sterile salt solution or sterile vaseline.

The transfusing is continued until ill effects are noted in the donor. The latter should always remain in bed for a few hours after the operation.

Another method has been originated lately in which instead of opening and uniting the veins of the donor and recipient the blood is transferred from one to the other by means of special syringes called, after the inventor, the *Linderman syringes*.

Care Necessary during Operation.—Both patients should be made comfortable, as the operation often takes some time; cracked ice, drinking water, and rectal stimulation should be provided. The blood pressure, pulse, and general condition of the donor must be watched; in fact, the pulse should be counted every few minutes, for prostration is likely to occur.

The instruments and other articles used for the operation, except when the Linderman syringes are employed, are:

Special canula.
Tenacula, very small, 3.
Retractors, very small, 2.
Scalpel, 1.
Scissors, small, sharp-pointed, 3.
Forceps, plain, small size, 2.
Forceps (mouse-tooth), small size, 2.
Needles, straight and oval, very fine, 6.
Mosquito artery clamps, 6.
Seraphine clamps covered with rubber tube, 4.
Suture silk and catgut.
Sterile towels.

Sterile sponges.

Gauze compresses.

Bandages.

Local anesthetic. If cocain is used, two hypodermics must be prepared.

Phlebotomy.

Nature of Operation.—Phlebotomy, or venesection, is the taking of blood from a vein. It is performed either to relieve arterial or venous engorgement, or to remove toxic blood from the body—as in gas and uremic poisoning. In the latter case, the phlebotomy is generally followed by an intravenous infusion.

Requisites:

Aneurism needle, 1.

Artery clamps, 2.

Forceps, 2.

Probe, 1.

Scissors, 1.

Scalpel, 1.

Needles, 2.

Sterile sponges, 12.

Sterile towels, 2.

Catgut.

Black silk.

Kidney basin, 1.

Dressing rubber, 1.

An 8-ounce graduated glass into which the blood is received.

A solution basin of sterile salt solution. The solution is used to wash the blood from the arm before putting on the dressing.

A gauze compress.

A bandage.

With the exception of the dressing rubber all these articles must be sterile.

Preparation of the Patient.—This is the same as for an intravenous infusion.

Nature of Operation.—This consists in opening a vein and allowing the required amount of blood to escape and then suturing the wound.

Vaccination and Injection of Antitoxins

Difference between Vaccines and Antitoxins.—A vaccine contains the micro-organism that causes the disease; an antitoxin contains, not the organism, but products secreted or excreted by the organism.

Usually the organisms used for vaccines are dead or else their virulence has been attenuated in some way. Examples of vaccines of which the active principle are dead bacteria are typhoid fever, Asiatic cholera, and the bubonic plague. Some of the ways in which the virulence of micro-organisms are attenuated are as follows: (1) By passage through the body of another species of animal; *e. g.*, the virus used for protection against smallpox contains, without doubt, the organism that causes the disease, weakened by its growth in the body of the heifer. (2) By desiccation; *e. g.*, the active principle of the virus used for inoculation against hydrophobia is obtained from the dried spinal cord of animals that have been inoculated with and died from the disease, and though the specific organism that causes the disease has not yet been isolated, experiments and clinical experience have shown that it is in the spinal cord of animals which die

of the disease. (3) By growth on culture media under circumstances that are not conducive to the development of the organism; *e. g.*, in an atmosphere with a temperature above the optimum or in the presence of a weak antiseptic.

An idea of the nature of an antitoxin will be, perhaps, obtained most easily by a description of the preparation of the diphtheria antitoxin. This is about as follows: A culture of Klebs-Löffler bacilli—the germ which causes diphtheria—is grown in nutrient bouillon for about eight days. At the end of this time, the bacilli are killed by the addition of carbolic acid to the bouillon, whereupon the germs sink and settle on the bottom of the flask and the liquid is then filtered off. This filtrate is known as the diphtheria toxin. A horse is injected with a dose of this toxin, the strength of which is estimated at being just short of fatal. The animal becomes very ill and his body at once begins to manufacture an antidote for the poison—see page 661. When a sufficient amount of this antidote has been made to neutralize the toxin, the horse recovers. Then he is inoculated with a dose of the toxin, twice the size of the first dose and, upon his recovery from the effects of the second injection, he is given a third one, and so on until he fails to be made ill by a dose a thousand times as strong as the first dose, because his blood is full of a substance which will unite with and neutralize the action of the toxin. From three to six liters of blood are then drawn from one of the horse's jugular veins. This blood is allowed to clot and the serum which is extracted from the clot is the *diphtheria antitoxin*. The strength of the antitoxin is tested by inoculating guinea-pigs. The strength is expressed in the term of

units and the bottles containing it are labeled according to the strength of the dose they contain as "1000 units," "3000," "6000 units," etc.

Antitoxins are given both to prevent the contraction of a disease and to abort the disease. Generally larger doses are used in the latter case than the former; a very common prophylactic dose of diphtheria antitoxin being 1000 units, though doses of from 3000 to 16,000 units are given when the child already has the disease, the larger quantity being used when the child is very ill.

Difference between the Physiological Effect of Vaccine and Antitoxin in the Body.—Especially when living bacteria are used, the vaccinated individuals usually have a mild attack of the disease and their own cells form the antitoxin which protects them or renders them immune from future attacks—see page 661. Such immunity is spoken of as active immunity. When antitoxins are used, however, the individuals are simply the recipients of the protective substances—antitoxins—that have been formed in the body of some other animal, and, though they may be slightly indisposed by the injection of this foreign substance into their body, the reaction that takes place is in no wise similar to that which occurs when a vaccine is used, and their cells do not form any antitoxin. Immunity from a disease gained by the use of antitoxin is spoken of as *passive immunity*. This is not as permanent as active immunity.

Articles Required for Injection of Antitoxins.—These are:

A syringe and needle.

The bottle of antitoxin.

Collodion and sterile swab.

Disinfectants for the skin.

The patient's skin at the point of puncture is cleansed and disinfected in the same manner as for aspiration. The usual sites of injection are the outer aspects of the thigh, the back part of the axilla near the angle of the scapula, and the upper portion of the abdomen.

Methods of Using Vaccines.—The typhoid vaccine is injected in the same manner as the antitoxins. The smallpox vaccine is usually given by inoculation—*i. e.*, the skin is scraped and the virus rubbed in. The site chosen for vaccination by this method is either the outer surface of one of the arms or thighs. The skin must be cleansed and disinfected as for the giving of antitoxin.

The articles required are:

The vaccine virus.

A scalpel or needle.

A toothpick for spreading the virus.

Disinfectants for the skin.

All these articles must be sterile.

In some States, the Board of Health supplies sealed cases containing a capillary tube of sterile virus, a sterile needle, sterile flat toothpick, and a small piece of sterile rubber which fits over the tube and is used to blow the vaccine out of the tube.

Tuberculin

Nature and Uses of Tuberculin.—Tuberculin consists of media containing extract of the tubercle bacilli. The bacilli are grown in the media for several weeks and then killed and removed. When tuberculin was first prepared it was hoped that it would be

curative and preventive, but it has not proved to be either, and at present it is used more frequently for diagnostic than for therapeutic purposes.

Methods of Using Tuberculin for Diagnostic Purposes.—There are several methods in general use; some of the more common are: (1) The Moro Cutaneous Test. An ointment consisting of lanolin and 50 per cent. tuberculin is rubbed into the skin after the latter has been thoroughly cleansed and disinfected. If the patient has tuberculosis, small papules and vesicles will usually appear on the anointed area within twenty-four to forty-eight hours, but if the patient has not tuberculosis, there will be no reaction. (2) The Von Pirquet Cutaneous Test. The skin of the patient's forearm, after being cleansed and disinfected, is scarified and the tuberculin rubbed in. The affirmative sign is the same as with the Moro Test. (3) The subcutaneous test. The tuberculin is given by hypodermic injection. The affirmative reaction following the use of tuberculin in this way is a sharp rise of temperature within six or eight hours after the injection. A chill often precedes the rise of temperature, and with the fever there may be a rapid pulse, headache, nausea, and general malaise. (4) The Calmette Test. The tuberculin is dropped into the conjunctival sac. If the patient has tuberculosis, redness of the conjunctiva usually follows. This test is not now used as much as the others because a severe conjunctivitis has sometimes followed its injection.

Methods of Obtaining Blood for Examination

Purposes of Examination.—The more common reasons for investigation of the blood are: (1) To

determine the percentage of hemoglobin, and the number, relative proportion, and form of the red and white corpuscles. (2) To discover if there are any micro-organisms present.

Normal Proportion of Red and White Corpuscles and Hemoglobin.—Normally, there are approximately 5,000,000 red blood corpuscles in a cubic millimeter of blood, and 5,000 to 10,000 white corpuscles, the ratio of white to red cells being one to five hundred. The proportion of hemoglobin is expressed in terms of per cent. The amount of hemoglobin usually found in the blood of a normal individual is about 14 grams in every 100 c.c. of blood or about 1½ lbs. in the entire body; this amount therefore is considered as being 100 per cent.

Conditions which Cause Changes in the Proportion of Red and White Corpuscles and Hemoglobin.—Even in health, slight changes occur in the number of cells present in the blood, for, as the student will have learned in physiology, these cells are being constantly disintegrated and new ones just as constantly being formed. Also anything which will change the degree of the concentration of blood, as the drinking of large amounts of liquid, profuse perspiration, purging, etc., will naturally increase or decrease the comparative proportion of the cells and liquid of the blood. Any great or permanent change of the proportion of cells or of hemoglobin, however, is indicative of abnormal conditions. The usual abnormal change in the proportion of red corpuscles is a diminution of their numbers, and the condition produced by such a decrease is known as *anemia*. An increase in the number of cells is known as *polycythemia*. The causes of these conditions will be dis-

cussed in the section of Chapter XXV devoted to diseases of the blood.

Though the hemoglobin is contained in the red corpuscles, the maintenance of a proper amount of hemoglobin is not entirely dependent upon the number of red cells present, for under certain conditions—as following hemorrhage or sometimes when an individual is in poor health from any cause—enough red cells may be made to keep their count about normal, but they may be deficient in hemoglobin.

Examination of white corpuscles or leucocytes under the microscope shows that there are different kinds of these cells. In one variety, the protoplasm is filled with fine granules and each cell has several nuclei of various shapes; hence they are called *polymorphonuclears*, and as their granules are stained by neutral dyes they are also called *polymorphonuclear neutrophiles*. These normally constitute about 70 to 72 per cent. of the white corpuscles. Another variety of white corpuscles contain very coarse granules and are stained by a dye named eosin; these are therefore known as *polymorphonuclear eosinophiles*. In normal blood, the eosinophiles constitute only about two to four per cent. of the leucocytes. Still another variety of leucocytes found in normal blood are the *mononuclears* or *lymphocytes*. They were called *mononuclear* because they have but one nucleus, and *lymphocytes* because it was thought that they were made in the lymph nodes. There are large and small mononuclears. There is yet another type of leucocytes known as *myelocytes*, but these are only found in the blood in the disease known as *leukemia*. They are distinguished from other leucocytes by having round nuclei, and they represent young leucocytes

which, normally, are found in the bone marrow and not in the blood. The comparative proportion in which the different kinds of leucocytes are present in the blood changes in certain diseases; *e. g.*, in diseases characterized by inflammation there will be an increase in the polymorphonuclear neutrophiles—*i. e.*, the fine granular leucocytes, and the condition is known as *leucocytosis*.

The increase of these leucocytes is nature's way of protecting the body, because, as already stated in the sections on inflammation, these leucocytes—which by virtue of their function are known also as *phagocytes*[1] —are intended to destroy the bacteria. A large increase in the number of these leucocytes is both a bad and a good sign. It is bad, because it means that the inflammatory process is severe, and good, because it shows that nature is fighting the disease vigorously. A severe inflammatory process with a low leucocyte count would indicate that the individual's system was too debilitated to fight the invading germs. An increase in the number of eosinophiles is found in diseases due to invasion by certain animal parasites as intestinal worms and the trichina—the parasite which causes the infection known as *trichinosis*—and in asthma. The number of large lymphocytes is especially increased in malaria and the small ones in tuberculosis. Thus it can be seen that examination of the blood greatly helps the physician to form a diagnosis. The methods used for such examination cannot be described here, but, as nurses must often help the physician to secure the required specimen of blood, it may be well to say a few words about the different ways in which it is obtained.

[1] From the Greek *phagein*—to eat and *kytos*—a hollow vessel.

(1) Blood Smears for Microscopical Examination.—These are usually made on sterile cover-glasses. The blood is taken from the lobe of one of the patient's ears or a finger tip. The skin of the part is cleansed with (1) alcohol, (2) sterile water. The skin is then pricked with a sterile needle, the drop of blood which comes to the surface is touched with a clean cover-glass and spread into a film by covering it with a second glass and pressing the two glasses together. The glasses are then drawn apart and exposed to the air until dry. The cover-glasses are handled with forceps to prevent injuring the smear by moisture of the fingers, and, to facilitate moving it, the second cover-glass is put over the first one with its corners projecting.

(2) Blood for Enumeration of Corpuscles.—To obtain blood for such a purpose, a small capillary tube, one extremity of which is blown into a bulb and the other provided with a piece of tubing, is used. The tip of one of the patient's fingers is washed with (1) alcohol, (2) sterile water, and then pricked with a sterile needle, and as much of the drop of blood issuing from the prick as is required is drawn into the bulb by putting the tubing between the lips and sucking.

(3) For the Estimation of Hemoglobin.—A finger or ear is pricked as when obtaining blood for the purposes already referred to, and a small piece of filter paper touched to the drop of blood; the consequent stain on the paper is compared with a standard color scale. This consists of a lithographic plate representing the colors of ten solutions of hemoglobin ranging from 10 to 100 per cent. This method of estimating hemoglobin is known as the *Tallquist Method*. There are other more complicated

methods for which the blood is obtained in a capillary tube as described in the preceding paragraph.

Blood Cultures.—In order to discover if certain bacteria are in the blood, blood cultures are sometimes made and about 10 c. c. of blood are required for the purpose. This blood is usually obtained from the patient's median basilic vein, and the same precautions are observed as when phlebotomy or intravenous infusion is performed. The syringe and needle used are sterilized in an autoclave or by boiling. The preparation for the operation is about as follows: The patient's arm is disinfected as for phlebotomy, and while the operator is washing his hands the nurse usually ties a bandage about the upper part of the arm. The bandage must be made tight enough to cause the veins in the elbow bend to stand out prominently, but not so tight as to obliterate pulsation in the radial artery. If the patient is delirious or very nervous, the arm is bound to a basswood splint. A sterile towel is put around the arm and forearm and another around the upper part of the arm. The operation consists in inserting the needle which is attached to the syringe into the vein. If the vein is well distended, the pressure in it is great enough to force the amount of blood required through the needle into the syringe. The blood thus obtained is distributed in some test tubes containing culture media and these are taken to the bacteriologist.

Intubation

Nature and Purpose of Operation.—Intubation is the introduction of a tube into the larynx through the glottis. The operation is performed to prevent

asphyxia from obstruction in the upper part of the larynx.

INSTRUMENTS.—The instruments which make it possible to perform this operation were invented by the late Dr. O'Dwyer of New York and are therefore generally known as the *O'Dwyer Intubation Instruments*.

An intubation set consists of:

A mouth gag to keep the patient's jaws apart during the operation.

The introducer.

The extractor.

The tubes.

The obturators.

All intubation sets contain several tubes of graded size. Those for children are numbered, and the number chosen should be the one agreeing approximately with the child's age. A loop, some eight inches long, of heavy silk thread, is tied through the perforation in the neck of the tube. Inside the tube is a piece of metal called the obturator, and to this the introducer is attached before inserting the tube.

POSITION OF THE PATIENT.—An adult lies in the horizontal position on a table or bed; the head must be perfectly straight. A child should be restrained by rolling a sheet around it as described on page 179, and either placed in the horizontal position on a table or held on a nurse's lap with its head resting against her shoulder. The child's head must be kept perfectly straight. If possible, it is well to have an assistant hold the child's head and the mouth gag. If the doctor uses a head-mirror, an artificial light will be required, and the lamp must be placed so that the light will fall upon the mirror and the patient placed

so that the light from the mirror will enter its throat. If the doctor does not use a mirror, the patient must be placed so that the light from the window or lamp will enter the throat.

While inserting the tube, the operator sits facing the patient. He introduces the index finger of his left hand into the mouth, and with it holds the tongue down and the epiglottis forward. After seeing that the silk loop is free, he passes the introducer, connected with the obturator in the tube, into the mouth alongside his finger, slips the tube into the trachea, and presses it into position with the finger of left hand. He then immediately removes the obturator. If the tube is in the trachea, the patient's breathing will be much improved, as soon as the first gush of mucous discharge that takes place upon the introduction of the tube is over. If it has been put into the esophagus, no improvement will take place. It is partly to avoid accidents from this mistake that the silk thread is attached to the tube, as it can be easily pulled out with the string. This thread is sometimes left attached to the tube, as long as the latter remains in the larynx; but, as a rule, it is pulled out as soon as the tube is securely in place, the tube being removed, when required, with the extractor. The chief objection to leaving the thread in the tube is that a child, unless its hands are continually tied, is likely to pull the tube out at any time by pulling the thread. Before removing the thread, cut off the knot, otherwise, if the wrong end is drawn through the tube, the knot coming to the hole will displace the tube. When the thread is left on, fasten it over the ear, and secure it by putting a strip of adhesive plaster over it, across the cheek.

CHAPTER XXIII

OPERATING ROOM TECHNIQUE

Care of the Operating Room. The Cleaning and Sterilization of Utensils, Instruments, etc. Care of Utensil Sterilizers. Different Kinds of Sterilizers Used for Sterilizing Surgical Supplies. Care Necessary in the Use of Sterilizers. Disinfection of the Hands. Preparation of Sterile Surgical Supplies. Care of Patient. Preparation for Operation in a Private House. A List of Common Operations.

Care of the Operating Room and its Contents

IT will be impossible to prevent the infection of wounds unless the rooms in which operations are performed and where the sterile supplies are prepared and stored are made and kept absolutely clean.

Means of Preventing the Entrance of Dust.—One essential in keeping the operating rooms clean is to prevent, as far as possible, the entrance of dust and dirt from the outside. In order to effect this, all windows that connect directly or indirectly with the operating room are screened with fine wire, and the screens covered with two thicknesses of gauze, which are frequently changed. Ventilators intended for the admission of air are likewise covered.

Care of the Walls and Floors.—The walls of the operating rooms are washed with soap and water at least once a month, and those of the adjoining

rooms every two or three months. The floors are scrubbed daily with water and soap powder, and, after a series of operations, the operating-room floor is scrubbed with (1) water and soap powder, (2) carbolic. After each operation the floor space beneath and around the operating table is mopped with carbolic solution 1:120 and, if there was any infectious material on the floor, carbolic 5 per cent. is poured over the part where it was and allowed to dry. The mop used between operations is kept exclusively for that purpose, and when not in use stands in a disinfectant. A weak solution of chlorid of lime is often used for this purpose.

Care of Furniture.—The furniture is dusted daily with a damp duster and all spots on it removed. Bon-ami is one of the best things to use for the latter purpose, except when the spots are on metal and due to iodin and bichlorid of mercury. Such stains it has been found can be removed readily and perfectly with the *Universal Metal Polishing Paste*—made by Borsum Bros., N. Y., and *U. S. Infallible Metal Polish*—made by Hoffman, Indianapolis, Ind.

Care of Utensils and Utensil Sterilizers.—All articles of glass or enamel-ware are thoroughly washed in hot green soap solution as soon as they are received in the operating pavilion. Each morning all utensils used for operations are scoured with bon-ami and soda solution, and spots removed with a weak muriatic solution. The sterilizers, in the meantime, are emptied of water, scoured with sapolio, filled with fresh water, and the utensils then put into them. When needed for operation, the latter are boiled for at least five minutes. After use, they are boiled for the same length of time and then scoured with soap and water.

When sterilizing glassware, the precautions mentioned on page 46 must be remembered. To keep enamel bowls, pitchers, etc., in a presentable condition, care must be taken when placing them in the sterilizer to do so gently, for the enamel is easily cracked and nicked, and when this happens it soon peels off and spots of rust appear.

Another precaution necessary to keep the sterilizers, utensils, etc., in good order is to have the water supply for the sterilizers filtered, otherwise a deposit is left to coat the inside of the sterilizers and to cling to the utensils and instruments. Though this deposit is sterile it does not improve the appearance of the utensils, and it makes their cleansing an unnecessarily difficult task.

Care of Instruments.—Instruments are sterilized before and after use as follows: Blunt instruments are boiled in a one per cent. sodium carbonate solution for five minutes; sharp instruments, except knives, are boiled in the same solution for two minutes, and, unless the sterilizer is provided with a rack that will keep such instruments apart, all sharp points must be protected. Knives are soaked in alcohol 95 per cent. for at least thirty minutes. Blunt instruments are cleaned after use by (1) rinsing them in cold water; (2) sterilizing them as before use; (3) scouring them with bon-ami and hot soapsuds. Cutting instruments should be picked out from the others and sterilized separately; they are best cleansed by rubbing them with bon-ami or, if this is not effectual, emery on a cork. A brush should not be used on the cutting edge of instruments. Liquid albolene is dropped into the joints of scissors and clamps and into all grooves for sliding blades and the like. A fine cutting edge can

be kept on scalpels by polishing them with carborundum on a razor strop every day that they are used.

When instruments are discarded during operations they should be at once dropped into soda solution, for when they are allowed to dry in the air they become rusted, especially around joints, and this makes their cleaning a lengthy task.

Sterilizing Rubber Articles.—Articles made of rubber should not be sterilized with instruments since soda ruins the rubber. Rubber tubing for irrigators, Esmarch bandages, and the like are boiled for fifteen minutes in water or salt solution. Such articles are cleansed by scrubbing them with green soap and warm water. Rectal and stomach tubes and catheters are boiled for five minutes. Cold water should be run through them before they are sterilized after use. They are cleansed in the same manner as rubber tubing.

Rubber bulbs, articles made of hard rubber, silk catheters, and other things of like nature, which are ruined by boiling, are sterilized by immersion in carbolic 5 per cent. for thirty minutes and are rinsed in sterile water before use.

Care of Drainage Rubbers.—All rubbers used for drainage in the operating room are made of double-faced rubber. After use they are put into carbolic 1:40 and later scrubbed with warm—not hot—water and soap.

The Thermocautery.—The more common uses of the thermocautery during operations are for the destruction of mucous membrane in appendicectomy and operations upon the liver and bile-passages and in hemorrhoidal operations. As the thermocautery gets out of order easily, operating rooms are usually supplied with two such instruments and both of them

should be tested every morning. The method of preparing the cautery for use was described on page 412. During the interval between the heating and using of the cautery, keep the tip a dull red by pressing the rubber bulb occasionally; it should not be pressed more frequently than is required to keep the tip this color or the latter will be too hot for use. Should it become so, shut off the air for a few seconds by pressing the rubber tube. Before handing the cautery to the operator, envelop the part which he will touch in a sterile towel. Important points to remember in handling the cautery are (1) never take it near the anesthetic, nor (2) let the tip touch anything.

After use, clean the tip by heating it thoroughly, allowing it to cool, and then wiping it with a piece of soft gauze.

The Sterilizers.

Varieties of Sterilizers Used.—The main difference between the many varieties of sterilizers used for sterilizing surgical supplies is that in some kinds the steam can be put under pressure and in others it can not. The former types are now used in nearly all large hospitals, but the latter are still found in many small institutions and they are much used outside of the hospital.

The Arnold is the most used variety of sterilizer with steam not under pressure, especially the new Boston Board of Health pattern. This, as can be seen in Fig. 88, consists of a sterilizing chamber; a hood, which forms an outer wall to the sterilizing chamber and prevents loss of heat; a water-pan, and a pipe for conveying the steam to the sterilizing chamber. The principle of the more old-fashioned Arnold

sterilizer is the same as the newer one, the differences being that the former is cylindrical in shape and, instead of doors, is supplied with a cover and a hood that is lifted off. To use either kind, half fill the water-pan and place the sterilizer on a stove. When the water boils, the steam rises through the pipe connecting the water-pan and the sterilizing chamber into the latter where it condenses and falls back into the pan. An important point to remember when using either of these sterilizers is that the covers or doors must be opened as soon as sterilization is completed, otherwise the accumulated steam will condense and wet the material that is in the chamber. Surgical supplies sterilized in this way must be resterilized on two successive days. See page 46.

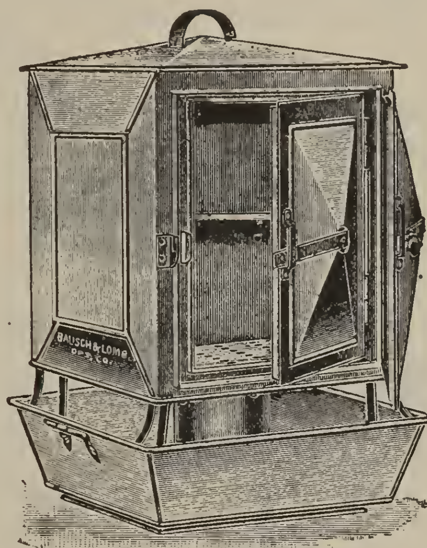


Fig. 88. Arnold Steam Sterilizer Boston Board of Health Pattern

The various types of sterilizers used for disinfecting surgical supplies with steam under pressure are known as *autoclaves*, or *steam-pressure sterilizers*, or *digesters*. The larger varieties that are used for disinfecting

mattresses and the like are called *steam disinfecting chambers* or *cylinders.*

There are several varieties of autoclaves. The majority of them consist of a metal cylinder supplied with a lid which can be tightly closed by screws and nuts and which is supplied with a safety-valve, a thermometer, a steam-pressure gauge, a water gauge, and a small vent or opening provided with a stopcock. Within the cylinder, is a metal sterilizing chamber the bottom of which is perforated for the admission of steam. The way in which steam is supplied varies. In the simpler autoclaves, the water is poured into the lower part of the cylinder and the heat is obtained from gas jets placed beneath the apparatus. In the larger varieties, the steam is usually supplied by a pipe leading from the regular heating supply and is let in or shut off as required by means of a valve. When the heating is done in this way there will be also another pipe provided to carry off any excess

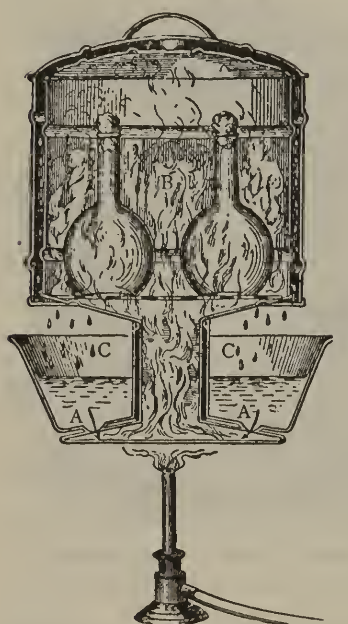


Fig. 89. Section through an Arnold Steam Sterilizer

steam. The autoclave is closed by a heavy door which, during sterilization, is secured by strong bolts. The outer cylinder and the space between it and the sterilizing chamber are collectively known as the steam jacket.

Purposes of the Different Parts of an Autoclave.—The steam jacket, in which the steam is kept circulating from the beginning to the end of sterilization, helps to avoid condensation in the sterilizing chamber and thus prevents the excessive wetting of the objects within it, and, after sterilization is completed, if the chamber is opened the steam in the jacket will help to dry anything that has become wet. The thermometer shows the degree of heat; the pressure gauge, the degree of pressure that the steam is exerting (see page 42); the safety-valve opens and allows the escape of steam, thus diminishing pressure, whenever the pressure within the apparatus exceeds the amount for which the valve is set. This, for surgical work, is usually 15 pounds (see page 42), and small autoclaves cannot stand a much greater degree. The water gauge shows the amount of water in the water chamber; the opening is for the purpose of allowing the air to escape.

Precautions Necessary in the Use of the Autoclave.—Before commencing to sterilize, it is necessary to see that the valve of the safety-valve is set for the degree of pressure required and that there is sufficient water in the water chamber. When packing the sterilizer, put a folded towel between the bottom of the sterilizer and flasks or other glassware, and do not let glass objects touch each other, metal, or any other unyielding substances; for, if they do as glass is expanded by heat, they are likely to break.

All air must be permitted to escape from the sterilizing chamber before the vent is closed; if this is not done, the air may collect about the objects being sterilized and, air being a poor heat conductor, they will not be exposed to the degree of heat registered by the thermometer. In the sterilization of liquids, at the conclusion of the process the door should not be opened until the apparatus has become sufficiently cooled for the pressure to be reduced to about five pounds; otherwise, the condensed steam will cause a diminished pressure, which will result in the superheated liquids boiling so energetically that the flasks may be broken or their stoppers blown out. If there are no liquids in the autoclave, the doors can be opened earlier, if absolutely necessary, but caution must be observed because the steam, being under pressure, will rush out instantly and scald anyone in front of the apparatus.

As the exact method of operating the autoclave varies with different makes and can be better demonstrated than described, no further description will be given here.

Disinfection of the Hands

There are several methods of disinfecting the hands in general use. The difference usually lies in the disinfectant that is used, the initial step being usually about the same, viz., to scrub for five minutes from the finger tips to the elbow with green soap and hot water, using a sterile, fairly stiff, bristle brush or, if the arms become too tender for the brush, a ball of sterile cotton wrapped in gauze. The cuticle under the nails is then cleansed with a sterile orange stick.

During the latter part of the scrubbing running water is used.

The methods of disinfecting most commonly followed are:

Method 1.—Equal parts of chlorinated lime and sodium carbonate, are taken, made into a paste with water, and rubbed into the skin for three minutes. (The combination gives off chlorin gas, which acts as a disinfectant.) This paste is rinsed off with sterile water.

Method 2.—Same as Method 1 but after the lime and soda lather has been removed, the hands and forearms are immersed for two minutes in a solution of bichlorid of mercury 1 : 1000.

Method 3.—The hands and forearms are immersed in hot bichlorid of mercury 1 : 1000 for two minutes, and then in a hot bichlorid-permanganate solution until the skin is deeply colored. The advantages of permanganate for this use are: (1) it penetrates the skin in a way that other disinfectants, except iodin, do not; (2) it forms a film over the skin and thus prevents the egress of bacteria from the deeper part of the skin. When permanganate is used, after operation, the hands and forearms are washed with (1) oxalic acid solution in order to remove the stains of the permanganate, and (2) with water containing ammonia so as neutralize the action of the acid.

Method 4.—The skin is painted with tincture of iodin 7 per cent.; this is allowed to dry and is then washed off with alcohol 95 per cent.

Method 5.—The hands and arms are immersed for three minutes in an alcoholic solution of bichlorid of mercury 1 : 1000.

Rubber gloves are now almost universally worn

during operation and, when necessary to touch sterile material, while preparing sterile supplies.

If the gloves are put on dry, the hands are first dried with a sterile towel and dusted with sterile talcum powder. Sometimes, however, the gloves are immersed in a disinfectant and then drawn on.

The gloves are cleaned and sterilized in the manner described in Chapter XXI. When the gloves are put on dry, each pair is, before being sterilized in the autoclave, encased in a muslin protector with a towel and a small amount of talcum powder in paper. The powder is wrapped in the paper and sterilized for thirty minutes previous to being put into the bundles.

The brushes and orange sticks used when disinfecting the hands are boiled for five minutes each day and are kept in 5 per cent. carbolic acid. They are rinsed after each use and at once replaced in the solution.

Preparation of Sterile Surgical Supplies

The nurse preparing sterile supplies must disinfect her hands as carefully as for an operation and take every precaution against infection of the material.

The methods of preparing supplies that are given here are ones that have been in use for some time, and frequent tests of the material by the bacteriologist have shown that these methods are adequate to render the supplies absolutely sterile.

Suture Material

Catgut, Plain.—Catgut for ligatures is usually purchased in bundles containing a specified number

of strands each about ten feet long. To prepare the gut for use:

(1) Wind it on clean glass reels, half a strand on each reel.

(2) Place the reels in an air-tight glass jar, cover the former with ether and allow them to soak for twenty-four hours, shaking the jar every four hours during this time.

(3) Pour off the ether and cover the reels with an alcoholic solution of bichlorid of mercury 1 : 500 made with 95 per cent. alcohol.

(4) Pour off the bichlorid solution and cover the reels with alcohol 95 per cent. Place the jar in a water-bath and allow the alcohol to boil for ten minutes. After this, the catgut is ready for use or it can be kept—in the same jar and alcohol—until required. The jar must be securely covered.

When sterilizing catgut, the inflammable nature of alcohol is to be remembered. Various forms of apparatus, such as the Dowd's condenser, which are guaranteed safe, can be bought, but nothing is safe unless care is exercised, and with care the "water-bath"—a deep dish containing water—is as safe as any more elaborate utensil. But the pan must be deep, and it must be large enough to extend well out beyond the flame. The gas should be lighted and the bath be in position before the jar containing the alcohol is put into the latter.

Another method of preparing plain catgut is:

(1) Cut each strand of gut in four pieces and either wind it on reels or coil each piece loosely around three fingers.

(2) Place the reels or coils in jars and cover them with Park's solution—*i. e.* mercuric chlorid, grains 15;

tartaric acid, grains 75; ether and Columbian[1] spirits, āā pint 1.

The length of time that the gut is left in the solution depends upon its thickness; thus:

Catgut	No.	0	remains	in	the	solution	4	hours.
"	"	1	"	"	"	"	6	"
"	"	2	"	"	"	"	8	"
"	"	3	"	"	"	"	12	"
"	"	4	"	"	"	"	16	"
"	"	5	"	"	"	"	20	"

(3) Pour off the Park's solution and cover the gut with Columbian spirits. It remains in this until wanted for use.

This latter method is simpler, quicker, and less expensive than the former, and the strength of the gut is not weakened when it is sterilized in this way as it sometimes is by the boiling necessary in Method 1. Care to have the gut covered by the solution at all times is more especially important when the gut is sterilized by the second method.

Chromicized Catgut.—Method 1: (1) Wind the gut on reels one half strand on each reel.

(2) Put into jar provided with a cover that will keep the jar *air-tight* and cover with 95 per cent. alcohol.

(3) Pour off alcohol and allow gut to remain in the covered jar for twenty-four hours.

(4) Cover with chromic[2] solution and leave gut Nos. 1 and 2 thus for twenty-four hours and Nos. 3 and 4 for three days.

[1] Wood alcohol deodorized.

[2] Chromic solution { Bichromate of potassium, 75 grains.
5 per cent. carbolic acid, 5 pints.

(5) Pour off the chromic solution and allow the gut to stand in the covered jar for twenty-four hours.

(6) Cover the gut with a 1:500 alcoholic solution of bichlorid of mercury made with 95 per cent. alcohol. Leave it thus for six days.

(7) Pour off the bichlorid solution and cover the gut with alcohol 95 per cent. Place the jar in a water-bath and allow the alcohol in it to boil for ten minutes. The gut is left in this alcohol until required for use.

Method 2: (1) Do not cut the strands of gut, but place them loosely in a jar or basin and cover them with a chromicizing solution consisting of chromic acid, grains 30; carbolic acid, 5 per cent., 5 pints. The length of time that the gut is left in the solution will depend upon its caliber, thus:

Size	No.	0	is	left	½	hour.
"	"	1	"	"	1	"
"	"	2	"	"	2	hours.
"	"	3	"	"	3	"
"	"	4	"	"	4	"
"	"	5	"	"	5	"

(2) The gut is removed from the solution, stretched on a frame made for the purpose, and placed in a moderately warm room for twenty-one days.

(3) Cut each strand in four, wind it loosely around the fingers, and place the resulting coils in jars; cover them with Columbian spirits and leave them thus for seven days. The object of this soaking is to remove the chromic solution, for it might irritate the tissues.

(4) At the end of seven days, pour off the Columbian spirits, cover the gut with alcohol 95 per cent.,

put the jars containing it in a water-bath, and allow the alcohol to boil for fifteen minutes.

(5) Repeat the boiling on three successive days. The gut is then ready for use.

Nurses should wear rubber gloves when preparing chromic catgut, for chromic acid stains are very difficult to remove.

THE CARE OF CATGUT.—After the sterilization of catgut is completed, the jars should be plainly marked with the date and placed in a closed case. They should be removed from the case or opened only when necessary to replenish the small jars which are kept near the operating table. Placing the date of sterilization upon the storage jars is a convenient way of determining which gut should be used first and prevents some gut being left to rot while that freshly prepared is served in its place. Gut once removed from a storage jar should never be returned, even though it has been in a sterile container.

TO PREPARE SILKWORM-GUT:

(1) Boil the gut for five minutes.

(2) Remove it from the sterilizer, place it in Columbian spirits and serve it from this.

PREPARATION OF HORSE HAIR:

(1) Soak the hair in a Castile soap and water solution for six days.

(2) Change the solution daily.

(3) Remove the hair from the soap solution, cover it with bichlorid of mercury solution 1 : 1000, and let it soak for twelve hours.

(4) Pour off the bichlorid and cover the hair with alcohol 80 per cent. Let it remain in this until wanted.

(5) Before it is used, boil the hair for three minutes.

Preparation of Silk and Thread Ligatures.—Silk, black and white, and Paquestecker thread are: (1) mounted upon the desired needles and run the full length of the silk, in and out through a towel; (2) boiled in water for five minutes at the time of operation.

N. B. Neither silk nor Paquestecker thread should be boiled in soda solution.

Another, though not as good, method of preparing silk and Paquestecker thread is as follows:

(1) Wind yard lengths around glass reels.

(2) Place the reels in glass tubes—three or four reels in a tube. Plug the tubes with cotton.

(3) Sterilize in an autoclave at 15 pounds' pressure, for one hour on two successive days.

Silk prepared in this way, except the heavier weights, is inclined to break.

Silver Wire.—This is sometimes used to hold fractured ends of bone together. It is sterilized by boiling for one half hour in normal salt solution. All small pieces of wire should be saved, for they can be returned to the manufacturers.

Preparation of Gauze for Dressings, etc.—Gauze for dressings is cut in two sizes: (1) one-half yard square and (2) one yard square. The gauze is either gathered around the edge and the latter turned in, forming a kind of loose ball, or else it is folded, forming flat compresses; all the raw edges are turned in.

Gauze for sponges is cut in pieces about nine inches square. It is folded in various ways, the essential point being that all raw edges are turned in.

Cotton sponges are made by tying small pieces of absorbent cotton in pieces of gauze about nine inches square. The tying is done with strong thread.

Laparotomy pads are made of four thicknesses of gauze. They are cut in three sizes: the largest ones being 12 by 15 inches; the medium, 12 by 7 inches; the smallest, 12 by 3 inches. The edges of the gauze are turned and stitched. In one corner of each pad a loop of tape is sewn. In the other end of this tape a small ring is fastened with a double knot before the tape is sewn to the pad.

The pads are packed in bundles of eighteen—six of each size. At the time of packing they are counted by the senior nurse, and the count verified by the head nurse, and they are counted again, both before and after operation, by the sponge nurse.

Gauze for packing and drainage is cut in three sizes: the largest size being 9 inches wide by 36 inches long; the medium, 4½ by 16 inches; the narrow, 2 by 18 inches. The gauze is folded lengthwise with either edge to the center and the two folds then doubled upon each other, with the result that the drains consist of four thicknesses of gauze and the raw edges are inside the fold. Each strip of packing is put in a glass tube and the tube plugged with absorbent cotton. They are sterilized in the autoclave for one-half hour at 15 pounds' pressure.

Sterilization of Gauze, etc.—Before sterilization, the amounts of gauze sponges and the like that will be required for each operation are encased in separate muslin protectors. These, as well as all towels, sheets, and the suits, aprons, and masks worn by the operator and his assistants, are sterilized in the autoclave for half an hour at 15 pounds' pressure.

For abdominal section operations, a binder is sterilized with the gauze intended for the dressing.

Cleansing of Gauze.—All gauze, except that used for packing and small sponges, which has not been used for septic cases, is in many hospitals prepared for re-use in the following manner:

(1) Soaking it in several changes of cold water, stirring it occasionally during the soaking.

(2) Washing it under running tepid water until all stains are removed.

(3) Boiling it for one half hour in normal salt solution.

(4) Wringing it out and drying it in the steam sterilizer.

(5) When required for use, sterilizing it in the usual manner.

Iodoform Gauze.—Fine absorbent gauze is cut in pieces one yard square, folded and sterilized for one hour; it is then soaked in iodoform solution (made according to the following formula), until it absorbs all the solution, after which it is folded and put in sterile tubes. Before handling the sterile gauze the nurse makes her hands surgically clean, puts on sterile gloves, and uses sterile dishes and towels.

Iodoform Solution for 5 yards of Iodoform Gauze:

Normal salt solution	300 c. c.
Iodoform	75 c. c.
Carbolic acid 5%	40 c. c.
Green soap, 50%	25 c. c.

Sufficient Castile soap to make a good lather.

Normal Salt Solution.—This is prepared by dissolving sodium chlorid in distilled water, in the

proportion of two grams of salt to 1 liter of water; filtering this until clear—usually about four times—into sterile flasks, plugging the flasks with paraffin paper and cotton, and sterilizing them in the autoclave for one hour with steam at 15 pounds' pressure.

Rubber Tissue.—To prepare rubber tissue for use in operations, scrub it with green soap, using a sterile brush; wash it with cold, sterile water and soak it in bichloride of mercury 1:1000 for twenty-four hours. Keep it in sterile normal salt solution.

Rubber Tubing for Drainage.—To prepare rubber drainage tubing for use in operations, scrub it with liquid green soap. Boil it for fifteen minutes before using.

Wicking Drains.—Lamp-wicking of various widths is often used for drains. The wicking is cut in lengths of nine inches, the ends are overcast to prevent fraying. They are sterilized in the same manner as the gauze drains.

Care of Patient in the Anesthetizing Room.—The nurse who accompanies the patient from the ward usually remains with her until she is under the influence of the anesthetic so that she will not be left with those who are strangers to her at this time. Before the anesthetizer begins to give the anesthetic, the nurse should ascertain if the patient has any false teeth on a plate and if so remove them, and she should unbutton the patient's nightgown at the neck. During the time that the patient is being put under the influence of the anesthetic, the nurse should notice the character of the pulse and be on the alert to restrain the patient should she become restless.

In many hospitals, it is customary for the nurse to keep a written record of the rate and character of the

patient's pulse, the time at which the anesthetic was commenced, and the time at which anesthesia was established. Before the patient is taken from the anesthetizing into the operating room, the nurse should see that the blankets covering the patient are in order and that she is in condition to be lifted from the stretcher.

Care of the Patient in the Operating Room.—Four important points to remember in connection with placing the patient on the table are:

(1) That she should not be exposed while being placed in position.

(2) That her body is to be well wrapped in blankets and that the blankets are to be arranged smoothly and in such a manner as to completely expose the part to be operated upon, but no other portion of the body.

(3) That, if the patient is in such poor condition that the use of hot-water bags is necessary, the bags must be well secured in heavy covers.

(4) That the arms must not be allowed to hang over the edge of the table nor must they be stretched in any unnatural position. Failure to observe such precautions has resulted in paralysis of the arm, due to injury of the musculo-spiral nerve, and in severe muscular pain. For the majority of operations, except those on the chest, the lower part of the face or neck, and those in which the patient has to be turned on her side, the arms are crossed on the chest and secured in place by turning the tail of the night-gown over them, tucking the ends firmly under the patient. In operations on the chest, the upper part of the abdomen, and in some face operations the arms are extended above the head, tied together, not too

tightly, at the wrists, and covered. In operations on the back and when the patient is in the Sims position, the arm of the affected side, or in the Sims position the right arm, is flexed at the elbow and tied loosely to the table, and the other arm rests naturally at the side and is likewise tied. Whatever the position, the arms must be placed in as natural a position as possible so that pressure and strain will be avoided.

Position of Patient.—The position in which the patient is placed on the table depends upon the nature of the operation. The following are some of the positions most commonly employed:

For abdominal operations, the horizontal or Trendelenburg position is generally used. The way in which these are secured was described in Chapter XVIII. When the operation is on the small intestine or female pelvic organs, the Trendelenburg position is nearly always used, since, when the body is in this position, the intestines fall toward the thorax and are thus more out of the operator's way. For operation on the upper part of the abdomen, a sand-bag or pad is sometimes placed under the dorsal spine.

For amputation of the breast, the patient is placed in the horizontal position with a flat sand-bag under the back at the affected side. The arm of the affected side is bent at the elbow, abducted to a right angle at the shoulder, and held in position by tying the wrist loosely to the table; the other arm is placed close to the patient's side and secured in place with the blankets. The patient's face is turned away from the affected side.

For operations upon the nose and mouth, the patient is placed in the horizontal position with several pads under the shoulders, so that the head will be lower than

the chest and the entrance of blood into the larynx thus prevented. Sometimes, instead of the arrangement just described, the patient's head is allowed to hang over the end of the table and in such case a pad must be placed on the edge of the table under her neck and her head be supported by a nurse.

For operations on the neck, the patient is placed in the horizontal position with a pad under the shoulders and neck of sufficient thickness to allow the head to rest on the table without excessive extension of the neck.

For vaginal operations, either the lithotomy or Sims position is generally used. These were described in Chapter XVIII.

For operations on the rectum, the lithotomy is the usual position.

For an operation on a kidney, the patient is placed in the Sims position—either upon the left or right side, as required—and an oblong sandbag placed under the side on which she is lying, on a line with the lumbar region.

Final Local Preparation of the Patient.—After the patient is on the table and the blankets and dressing rubbers are in place, the field of operation is usually washed with a disinfectant. The disinfectants used in many hospitals are: (1) 1:3000 iodine in benzine, (2) 3 per cent. alcoholic solution of iodine. The iodine is allowed to dry and remains on the skin. These preparations are not often used around the neck and face nor when the skin is tender, as in the case of infants and young children, for, in the latter instance, burns have sometimes resulted. The washing in such cases is often done with green-soap solution, 20 per cent., followed by alcohol, 80 per cent. For vaginal

and rectal cases, the cleansing is usually done with (1) green soap, 20 per cent., (2) either sterile water or bichlorid of mercury 1:1000. A sterile cotton ball is used for washing. After the field of operation has been scrubbed, a sterile fenestrated sheet is put over the rubbers and blankets. The opening in the sheet exposes the seat of operation. Sterile towels are placed around this opening. These are changed or covered with fresh towels during the operation as they become stained. Sufficient towels should be used to keep everything sterile, but there must be no unnecessary extravagance.

Preparation for Operation in a Private House

Choice of Room.—The two main considerations in the choice of a room are: (1) that it must be easily heated, for during the operation it should be about 76° F., and (2) that there is a good light. Also, the operating room should be near the patient's room and, if possible, a bathroom.

Preliminary Preparation of Room. — The amount of room preparation that should be done depends upon three things: (1) the nature of the operation, (2) the length of time that there is to prepare, and (3) whether or not the operation will have to be done in the patient's bedroom. This should of course be avoided if possible.

For a minor operation, all that is usually necessary is to move all articles of furniture not required out of the way and to dust the room thoroughly some time before the operation.

For a major operation, if it is possible to begin preparations the day before, it is well to remove the

carpet if there is one, unless the floor is old and contains cracks and crevices which will be full of dust, and all rugs, pictures, hangings, knick-knacks, and unnecessary articles of furniture, and to dust the ceiling and walls of the room with a duster wrapped around a long-handled brush, unless a vacuum-cleaner can be obtained. All cornices and corners should receive particular attention.

When preparations cannot be commenced on the day previous to operation, it is better not to remove pictures, hangings, and the like, because doing so would stir up dust that would not have time to settle.

The floor should be scrubbed or dusted with a damp duster and, after the furniture is in position and the operating table arranged, protected under and for a considerable distance around the latter with rubber, table oilcloth, or several thicknesses of paper covered with old, but clean, sheets. The latter should be secured in position with a few thumb-tacks.

If the light is glaring, or if people can see in from outside, whiting or sapolio can be rubbed over the window so as to form a film, or a piece of gauze can be tacked across it.

As much of the furniture as necessary, all the utensils, linen, and sterile dressings can, in nearly all large cities, be rented from Sick-Room Supply Bureaus, but, in smaller places and when the patient cannot afford unnecessary expense, the nurse must do the best she can to improvise and pick out, from articles to be had, those that will come as near the ideal as possible.

The articles of furniture usually required are: (1) Four small tables, or three will be sufficient if one has an under shelf. These tables are needed for the basins of hand solutions, the instruments, the sterile

dressing, sponges, etc., and the unsterile supplies. (2) An operating table. A long, narrow, kitchen table can sometimes be found which will answer the purpose, or two small tables that can be tied together or left apart and covered with a couple of boards which are tied to the tables and to each other. (3) A stand or other provision for the irrigator. (4) A stand of some kind for the anesthetic and the hypodermic tray.

The small tables are protected with rubber, oilcloth, or several thicknesses of paper, and the protector is covered with large towels or pieces of old muslin which are pinned to the legs of the table and just before operation covered with sterile towels. The operating table is covered with a pad made of an old blanket covered with a sheet. This must be tied or otherwise secured to the table.

The utensils likely to be required will depend of course upon the operation, but some that are nearly always needed are: a large fish or clothes boiler in which to sterilize the utensils; pitchers or pails, the number depending upon the size, to hold the necessary hot and cold sterile water and salt solution, and the extra supply of bichlorid solution for the hands; sterile nail-brushes, orange sticks, and bowl for the disinfectant at the washstand; an extra bowl of disinfectant for the hands on a small table near the operating table; small bowls containing the disinfectants required for the patient's skin; a tray for the instruments; three pails, one to receive the discharge of the irrigation, another in which to pour used hand solution, and the third to receive soiled sponges and the like; an irrigator or fountain syringe. These things can be rendered sterile by boiling them for twenty minutes. There must be also a hypodermic

syringe and whatever stimulant the surgeon orders and all the requisites for giving a hot salt-solution enema or irrigation; also rubber for drainage or a Kelly pad—the latter can be improvised by rolling a small blanket tightly over a stout two-inch bandage; the roll should be about one yard in length and nine inches in circumference; the bandage should be long enough to extend half a yard beyond the roll at either end. Proceed as follows: Roll the blanket in one end of a rubber sheet — this rubber sheet should be the width of the roll and sufficiently long for its free end to reach into a pail standing on the floor—tie the ends of the bandage together so that the roll will form an almost complete circle; pin the edges of the free end of the rubber together to form a drain. Table oilcloth, such as is used for covering shelves, etc., can be used instead of rubber sheeting.

Fig. 90. Improvised Kelly Pad

If a stretcher is required, one can be improvised by tying the legs of two strong straight-legged chairs together, tying pillows or a blanket across their backs, and then placing a sheet, folded as described on page 510, in the center to help when lifting the patient on to the bed. Or, instead of the chairs, a padded ironing board can be used for a stretcher.

An Arnold or similar sterilizer should be borrowed if possible, but, if one cannot be obtained, towels, sheets, and the like can be sterilized by suspending them in a hammock made of gauze or old muslin above

water boiling in a clothes boiler, and leaving them thus for one hour, and afterward drying them in a warm oven or by ironing them with a hot iron. In the latter case, the first sheet ironed should be kept to cover and iron the remaining linen on and it is not used for the operation. The hands of the one ironing should be disinfected.

Unless this sterilization is repeated on two successive days, the material cannot be considered absolutely sterile and should not be allowed to come in contact with the wound.

Sterile dressings can be bought at any drug store, and it is much better to buy them than to trust to home sterilization, unless adequate means for sterilization can be secured.

Gowns will be needed for the operator and his assistants, including the nurse. The surgeon usually has his own, and large aprons can often be found which will answer for those who have not. These can be sterilized in the same way as the towels. When nothing can be obtained which will answer the purpose, gowns can be improvised with sterile sheets. Two common ways of doing so are:

(1) Pin, with safety-pins, two small sheets together at the sides to within about seven inches of the top; pin the top edges together, leaving sufficient space in the center to pass the head through. The spaces at the top of each side are to put the arms through. Pin the ends of the sheet, which fall over the shoulders, around the arms three or four inches above the elbows. Do the pinning on one side before sterilizing the sheets. An assistant should pin the other side with sterile pins after the sheets are in place, being careful not to touch the front surface.

(2) Place a sterile sheet across the front of the body directly under the armpits; be careful while unfolding and placing it in position not to let it touch anything unsterile, and handle it with sterile hands, at the extreme edges. Bring the two ends over the shoulders and upper part of the arms, pin the upper edge of these ends together to the front of the sheet, carry the points under the arms and pin them so that they will form a short sleeve, pin the back edges of the sheet together at the back about the waistline.

A List of Common Operations

The following list of operations is supplied so that nurses may understand the meaning of the names:

Abscess, For, *i. e.*, a cavity containing pus.

Abscess, Ischiorectal, For, *i. e.*, an abscess in the ischiorectal fossa, *i. e.*, between the rectum and the ischium.

Abscess, Perinephritic, For, *i. e.*, an abscess around the kidney.

Adenectomy—The excision of a gland.

Advancemcnt—An operation to remedy strabismus.

Alexander's Operation—Fixation of the uterus by shortening the round ligaments.

Amputation—The removal of part of the body.

Ankylosis, For, *i. e.*, stiff joints.

Appendectomy or Appendicectomy—Excision of the vermiform appendix.

Arthritis, For, *i. e.*, inflammation of a joint.

Bursitis, For, *i. e.*, inflammation of the bursa—a small sac between movable joints.

Cellulitis, For, *i. e.*, inflammation of the cellular tissue.

Cholecystectomy—Excision of the gall-bladder.

Cholecystorrhaphy—Suturing of the gall-bladder.

Cholecystotomy—Incision of the gall-bladder.

Chololithotomy—Incision of the gall-bladder for the removal of stone.

Circumcision—Excision of the prepuce or foreskin of the penis.

Coccygectomy—Excision of the coccyx.

Colectomy—Excision of a portion of the colon.

Colostomy—Formation of a colonic fistula.

Colotomy—Incision of the colon.

Colpeurysis—Dilatation of the vagina.

Colporrhaphy—Suture of the vagina.

Cyst, For, see page 618.

Cystotomy—Incision of the bladder.

Ectopic Gestation, For, *i. e.*, extra-uterine pregnancy (pregnancy outside the uterus).

Empyema, For, *i. e.*, pus in the pleural cavity.

Enterorrhaphy—Suturing the intestines.

Enucleation—The shelling out of a tumor.

Epithelioma, For, *i. e.*, a cancerous growth of the skin.

Evisceration—Removal of the cornea and entire contents of the eyeball.

Fissure, For, *i. e.*, a cleft.

Gastrectomy—Resection of the pyloric end of the stomach.

Gastroenterostomy—The formation of a fistula between the stomach and intestine.

Gastroenterotomy—An intestinal incision through the abdominal wall.

Gastrorrhaphy—Suture of a wound of the stomach.

Gastrostomy—The formation of a gastric fistula.

Hemorrhoids, For, *i. e.*, blood-tumors at the anal orifice.

Hernia, For, *i. e.*, protrusion of part of the viscera.

Hernia, Femoral, For, *i. e.*, a hernia through the femoral canal.

Hernia, Inguinal, For, *i. e.*, a hernia into the inguinal canal.

Hernia, Strangulated, For, *i. e.*, a hernia that is impossible to reduce.

Hernia, Umbilical, For, *i. e.*, a hernia through the umbilicus.

Hernia, Ventral, For, *i. e.*, a hernia through the abdominal wall.

Hypospadia, For, *i. e.*, a fissure in the under surface of the penis.

Hysterectomy—Excision of the uterus.

Hysterorrhaphy—Suture of the uterus.

Keloid, For, *i. e.*, a tuberculous skin disease.

Kerectomy—Cutting out of a portion of the cornea.

Laminectomy—Excision of the vertebral lamina.

Lupus, For, *i. e.*, a tuberculous skin disease.

Mastoidectomy—Incision for mastoiditis (inflammation of the mastoid cells).

Myomectomy—Removal of uterine myoma (muscular tumors).

Nephrectomy—Excision of the kidney.

Nephrolithotomy—Incision of the kidney for calculus.

Nephropexy—The fixation of a floating kidney.

Nephrorrhaphy—Suture of the kidney.

Nephrotomy—Incision of the kidney.

Oöphorectomy—Excision of an ovary.

Osteomyelitis, For, *i. e.*, inflammation of the marrow of the bone.

Osteoplastic—Plastic operations upon bone.

Panhysterectomy—Excision of the ovaries, and uterus.

Perineorrhaphy—Suture of the perineum.

Plastic Operation—Operation to restore lost or imperfect parts.

Prostatectomy—Excision of the prostate gland.

Salpingectomy—Excision of a Fallopian tube.

Salpingo-oöphorectomy—Excision of a Fallopian tube and ovary.

Sclerotomy—Incision of the sclera (the outer membrane of the eyeball).

Sequestrotomy—Excision of necrosed bone.

Splenectomy—Excision of the spleen.

Splenopexy—Fixation of a movable spleen.

Suprapubic Cystotomy—Incision into the bladder above the pubes.

Tenorrhaphy—Suturing of a tendon.

Thyroidectomy—Excision of the thyroid gland.

Torticollis, For, *i. e.*, contraction of cervical muscles.

Trachelorrhaphy—Suturing the neck of the uterus.

Tracheotomy—Incision into the trachea.

Tumors, For removal of. See page 619.

Ureterostomy—The formation of an ureteral fistula.

Ureterotomy—Incision of a ureter.

Urethrotomy—Incision of the urethra.

Ventral Fixation—Fixation of the uterus by suturing to the abdominal wall.

A large number of operations are for the removal of cysts and tumors.

Cysts.—Cysts are sacs containing liquid or semisolid substance. There are several different kinds. Those likely to become much enlarged are:

Dermoid Cysts.—These are the result of error in development in consequence of which a piece of skin

or mucous membrane becomes isolated in the tissues and develops into a sac in which sweat, sebaceous matter, and hair collect. These cysts occur most frequently in the neck, near the rectum, and in the ovary. Those found in the ovary often contain teeth and pieces of bone.

Distention or Retention Cysts.—These are due to the blocking of a gland in consequence of which the secretion that is formed cannot be discharged and the gland becomes distended. They occur most frequently in the ovaries, jaws, breasts, and pancreas.

Parasitic Cysts.—These are generally due to a kind of tapeworm which sometimes infests the intestines of dogs. Its eggs, if taken into the human alimentary canal with food, develop embryos which find their way into the blood stream, and from thence into the tissues, most frequently that of the liver. There they give rise to large cysts, known as *hydatid cysts.*

Tumors.—Any kind of a swelling or morbid enlargement is often spoken of as a tumor, but in its present connection the word is understood to mean a mass of new tissue which grows independently of the surrounding structures. Such tumors are said to be either *innocent* or *malignant.* Innocent tumors push the tissues aside and do not infiltrate them in the same way as do those of the malignant type. They may give trouble by pressure but, otherwise, they do not usually cause pronounced symptoms of general ill health, and they do not tend to recur after removal. Malignant tumors, on the contrary, do all of these things.

The cause of tumors is unknown. Some authorities consider that they are the result of irritation or injury to the tissues. Others think that tumors are de-

veloped from embryonic cells which are produced in greater amount than the fetus requires and remain gathered at a certain point until stimulated to development by irritation due to injury or by the physiological activity of the part. Tumors, especially those of the malignant type, occur most commonly when the body is beginning to lose its vitality on account of age —*i. e.*, between the ages of forty-five and sixty—and in women the organs most likely to be attacked are those which are beginning to lose their function and atrophy—viz., the uterus and breasts. There are many different kinds of tumors; examples are:

Adenoma, an innocent tumor composed of gland cells. It may occur in the skin, breast, or any gland.

Angioma, an innocent tumor consisting of blood-vessels. It occurs most frequently in the skin, where it is known as a *nevus* or *birthmark*.

Carcinoma, a malignant tumor composed of gland cells. It may occur wherever glandular tissue is present, but the most common sites are the breasts, uterus, stomach, intestines, pancreas, and kidneys. There are several varieties which are distinguished by special names.

Chondroma, an innocent tumor composed of cartilage. It occurs most frequently in the fingers of rickety children.

Fibroma, an innocent tumor composed of fibrous tissue. It occurs most frequently in the uterus, ovaries, or gums.

Glioma, a tumor composed of branching connective-tissue cells. It occurs only in nerve tissue. It may be either innocent or malignant.

Gumma, a soft gummy tumor that sometimes occurs in tertiary syphilis. It is made up of tissue that

resembles granulating tissue and forms firm nodules which grow slowly and, later, tend to disappear.

Lipoma, an innocent fatty tumor that forms most frequently under the skin as a soft, lobulated, painless swelling which can be easily shelled out. They are often multiplied and may appear in any part of the body where fatty tissue develops.

Lymphangioma, an innocent tumor composed of dilated lymph-vessels. It occurs in the tongue.

Myoma, an innocent tumor composed of unstriped muscular tissue. It occurs most frequently in the uterus, where it is usually multiple.

Myxoma, a mucoid tumor; *e. g.*, a polypus of the nose.

Neuroma, an innocent tumor composed of nerve fibers. It is peculiar to the trunks of nerves.

Odontoma, a tumor that develops from a part of a tooth or its developing germ. It may be either innocent or malignant.

Osteoma, an innocent bone tumor that grows from the skull bones and the long bones near the epiphyseal junctions. When in the latter location, an osteoma is known as an *exostosis*.

Papilloma, a malignant tumor consisting of epithelium that arises in the skin or mucous membrane, especially at or near the orifices of the body. It usually begins as a wart or ulcer.

Sarcoma, a malignant tumor composed of embryonic connective tissue. It may occur in any part of the body, at any period of life, and is the only malignant tumor likely to appear in individuals under about forty years of age. Secondary growths are likely to occur in various parts of the body, being spread by the blood and lymph.

CHAPTER XXIV

EMERGENCIES

Surgical Emergencies: Burns and Scalds; Dislocations; Fractures; Sprains; Contusions; Wounds; Foreign Bodies in Ears, Eyes, Nose, Trachea, and Tissues; Hemorrhage; Shock. Medical Emergencies: Apoplexy; Asphyxia (Artificial Respiration); Collapse; Convulsions; Drowning; Epilepsy; Fainting; Hysteria; Intoxication; Poison; Sunstroke.

OUTSIDE the hospital, a nurse will often be obliged in emergencies to take the entire responsibility of a case, though she must remember that, except in very simple accidents, she is to do only that which is absolutely essential, and must get a doctor as soon as possible. In the hospital (barring extreme cases, such as hemorrhage) there is not much for the nurse to do in emergencies except to notify the doctor, get ready everything that he will require, and give him prompt and intelligent assistance in his work. Nevertheless, in the hospital, as well as outside of it, she must act quickly and know how to do all that may be necessary.

Emergencies may be divided into two classes, surgical and medical.

Surgical Emergencies

Burns and Scalds.—A scald is an injury to the tissues caused by moist heat, while a burn is a like

injury produced by dry heat. The treatment in both cases is practically the same.

Burns are classified according to the depth of the injury, as being of three degrees: first, redness of the skin; second, vesication; third, charring of the skin and deeper tissues.

Burns of the third degree will of course do serious damage to the tissue and function of the affected part; but, so far as the danger resulting from shock and systemic after-effects are concerned, it is not the degree of the burn, but the extent of the skin surface destroyed, that is of importance.

Shock is always to be expected, and treatment for it must be applied after a burn of any extent. It must be remembered that the patient need not necessarily be unconscious or in a state of coma to be suffering from shock. Patients who have never been unconscious have died from heart failure, resulting from shock.

Other causes of death following burns are: pneumonia, resulting from the irritation of the bronchi and lungs, due to the inhaled smoke; hemorrhage, from the sloughing of the blood-vessels; sepsis, from the absorption of the purulent discharges; and inflammation of the internal organs, from the absorption of septic material. Death from the last two causes may not take place for several weeks, but a fatal issue is likely to follow burns, if more than one third of the body is involved, and will almost certainly occur, if two-thirds of the skin surface has been destroyed.

Burns are produced by the action of fire, strong acids and alkalies, electricity and X-rays.

Burns Due to Fire.—If your own clothes should

catch fire, lie down on the floor and press the burning portion to the ground. Keep your mouth shut, to avoid the inhalation of smoke. If another person is the sufferer, wrap him quiekly and tightly from *head* to *foot* in a blanket, rug, or other heavy woollen artiele, beginning at the head, and hold him on the floor. While putting the blanket around the patient, keep it between you and the flames. Before removing the blanket, be sure that the flames have been smothered.

Treatment.—Shoek is the first thing to be eonsidered in the treatment of burns. Loosen all elothing; keep the patient quiet and in the reeumbent position, with the head lowered; apply heat; give plenty of fresh air. When removing the clothing, endeavor not to break the skin of the blisters if sueh have formed. Gauze, elean, soft linen or eotton, wet in a saturated solution of biearbonate of soda or earron oil,[1] are the dressings most frequently used. The biearbonate of soda has the advantage of being odorless and eleanly, and is generally easily obtained. Its use is eontinued for only two or three days and is followed by a dressing of sterile borie aeid, zine oxide, or other ointment (see Chapter XVI). When dressing extensive burns, do not expose a large area at a time, and apply the dressing so that it ean be removed in seetions. In many hospitals the "open treatment" is now used; the patient is kept in a warm-air bath, deseribed in Chapter XI, and the wounds dusted with stearate of zine and exposed to the air. In earing for severe burns, the danger of deformity, eaused by the eontraetion of the skin and underlying museles, must be

[1] Carron oil is a mixture of equal parts of olive oil and lime water.

remembered, and any suspicion of this condition reported. This danger can be somewhat obviated if treatment by the application of splints, or Buck's extension, is started in time; and massage, begun at an early date, is invaluable.

Burns Due to Acids and Alkalies.—Burns produced by an acid other than carbolic acid, are best dressed in the beginning with dry bicarbonate of soda. For carbolic acid burns, use alcohol. When burns are caused by an alkali, neutralize the effect by washing the part with diluted vinegar or lemon juice, and afterwards apply an ointment dressing.

For burns of the eye resulting from the introduction of strong alkalies, irrigate freely with warm water or boric-acid solution. For acids, apply a few drops of pure albolene or white vaseline.

Burns Due to Electricity.—These are treated in the same way as other burns. They are likely to be very serious, for extensive sloughing of the tissues usually follows burns made by electricity. Unless you have on rubber or heavy silk gloves, never touch a person with your hands who has received an electric shock and is still in contact with the current until the latter is shut off, since doing so will not help the patient and you will receive the full force of the current. Artificial respiration will be necessary if there is paralysis of the respiratory muscles.

Frost-Bite.—When treating a person for frost-bite, an important thing to remember is that heat is not to be applied. The frozen part should be rubbed, very gently—with snow or ice at first, and later with the hand or a towel—until the circulation is established. Until this occurs, the patient should be kept in a cool room.

Dislocations.—A dislocation is the displacement of any of the articular bones. It is associated with more or less injury of the ligaments. Its symptoms are: loss of function, rigidity, deformity, and pain.

Treatment.—An improperly reduced dislocation will result in permanent deformity. Therefore if any of the large joints are affected, a nurse should not do more than apply cold to keep down the swelling, and see that the extremity is properly supported, till a surgeon's services can be obtained. Dislocation of the fingers can sometimes be easily reduced by pulling them gently. A dislocated jaw can also, at times, be easily brought into place in the following manner: Protect the thumbs well, and place them on the back teeth, at the same time holding the fingers under the jaw. Forcibly depress the angle of the jaw, lifting the chin at the same time, and remove your thumb quickly, for the jaw will slip into place with a snap. A bandage is then applied to hold the jaw in position.

Fractures.—A fracture is a dissolution of continuity of the osseous tissue. The symptoms are: loss of function, abnormal mobility, crepitus, pain, swelling, and discoloration, the last-named being due to extravasation of blood and serum at the point of fracture.

A fracture may be simple,[1] compound, complicated, comminuted, impacted, multiple, or greenstick.

In a simple fracture, the bone is severed, but there is no wound in the tissue at the seat of fracture, exposing it to the outer air. A compound fracture is

[1] Scudder, in his *Treatment of Fractures*, uses the more definite terms "closed" and "open" fractures, instead of those so long in use, "simple" and "compound."

one in which the air communicates with the ends of the broken bone. A fracture is said to be complicated, when wounds are present at some other point than the seat of fracture, or when a joint, nerve, vessel, etc., is involved. In an impacted fracture, the broken ends of the bone have been forcibly driven into and fixed against each other. In a comminuted fracture, the bone is broken, or crushed, into many pieces, and the breaks communicate. A multiple fracture differs from a comminuted fracture in that, though there are many breaks, they do not communicate with each other. A greenstick fracture is an incomplete fracture. This form of fracture occurs most frequently in children, because, owing to the gelatinous nature of their bones, they are not easily completely severed.

Fracture of the lower end of the fibula, complicated with dislocation of the ankle joint and fracture of the inner malleolus, is called Pott's fracture. This form of fracture is complicated with great deformity and turning out of foot. Fracture of the lower end of the radius is known as Colles's fracture.

Separation of an epiphysis is a fracture between the shaft of a bone and the epiphysis; *i. e.*, a piece of bone separated from a long bone by cartilage. Such a fracture will be near a joint and will occur only under twenty-five years of age, since after that time the cartilage has become bone.

According to the direction of the break, fractures are said to be longitudinal, oblique, or transverse.

Treatment.—It is a mistake to imagine that a fracture must be reduced immediately. Far more harm is done by unskilful setting than by allowing the patient to wait some hours, or even two or three

days, until the swelling has disappeared and proper aid can be secured. In the meantime, handle the fracture as little as possible and apply temporary splints to keep the broken bones in apposition and to prevent pain from the spasmodic twitching of the muscles. These splints can be made by binding pieces of board, shingles, strong pasteboard, a rolled pillow, a couple of umbrellas or walking-canes, on either side of the extremity.

Apply cold, such as ice-caps, or compresses wrung out in an iced solution, such as lead and opium, to control the swelling, which, if it becomes severe, will make the fracture harder to reduce.

In a case of fractured thigh, extend the leg and bind to it a splint which is long enough to reach from the axilla to the heel. When the fracture is of the leg, the splint need extend only from the heel to above the knee. When the patella is fractured, the bones are kept in apposition by the application of a long splint placed behind the knee-joint. For a fracture of the forearm, bind a well-padded splint on each side of the arm, keeping the thumb up and leaving the fingers above the knuckles free, and place the arm in a sling. For a fractured clavicle, have the patient lie on his back, without a pillow, and bind the arm on the injured side across his chest. For fractured ribs, keep the patient quiet, pin a broad binder tightly across his chest, and watch for any bloody expectoration—puncture of the lung by the broken bone being a common complication. For a fractured pelvis or spine, keep the patient on his back, and very quiet, and put a fracture-board under the mattress.

For a fracture of the skull: Keep the patient quiet. Watch for twitching, convulsions, or paralysis of any

part of the body, and report any such symptoms immediately, as they denote pressure upon some part of the brain. Blood oozing from the ears, mouth, or nose, or ecchymosis around the eyes, usually means that the fracture is at the base of the skull—a very serious condition. Keep the blood washed away, as it is a good culture media for germs. Apply ice-caps to the head.

Great care must be taken in handling fractures. A simple fracture may be made compound by careless handling. When lifting the wounded part, apply support under the point of fracture and under the joints both above and below it. The wound in a compound fracture must be carefully cleansed and dressed with the usual antiseptic precautions.

Repair of Fractures.—The process that takes place in the healing of broken bones is much the same as that which occurs in the healing of wounds in the softer tissue. First, blood is poured out around the ends of the severed bone, and clots. This clot is invaded by the leucocytes which pass from the congested blood-vessels surrounding the parts and by connective-tissue cells and, as described on page 526, new capillaries and tissue are formed. Later, the granulating tissue in which the broken ends of the bone are embedded becomes permeated with lime salts and bone cells—osteoblasts—and gradually hardens into a viscous, fibrous mass that is known as *callus*. Under normal conditions, the callus will be solid by about the tenth day after the accident, but it will be fully six weeks before the callus between the severed ends will have changed to firm bone tissue. Excess callus around the point of fracture may be felt, and sometimes seen, as a prominent lump, for some time

after the bone has united, but, usually, this is gradually absorbed by the blood and so removed. If the periosteum is very badly injured, there is always danger that the bones will not unite, but will necrose; for severe injury to the periosteum will interfere with the blood-supply of the bone. Also poor health at the time of injury may retard or prevent firm union.

Sprains.—A sprain is a wrenching or twisting of a joint, accompanied by a stretching of the ligaments and tendons. A sprained limb should be elevated and supported, and treated with either very cold or very hot applications. Light massage is often prescribed after a few hours. The limb is firmly strapped or bandaged, and is permitted moderate use, unless there is some further complication. A nurse, being unable to differentiate between a sprain, dislocation, or break, should do nothing further than employ the hot or cold treatment until the patient has been seen by a doctor.

Contusions.—Contusions are injuries in which extravasation of blood into the cellular tissue takes place, due to the rupture of the superficial capillaries. The result is edema and discoloration of the skin.

Treatment.—The objects aimed at in the treatment of contusions are: The prevention of the further escape of blood into the tissues; the counteracting of any tendency to inflammation; the relieving of pain, and, in cases where the tissue is crushed, the restoration of vitality of the part. Either very cold or very hot applications are, therefore, the general remedy, the former being usually preferred in slight contusions, and the latter when the vitality of the tissue has to be considered.

Wounds.—Wounds have been described as "breaks

in the continuity of the soft tissues." According to their nature, they are known as:

1. *Contused* wounds. These are made by a blunt instrument, and are accompanied by more or less crushing of the surrounding tissue. The external hemorrhage from them is apt to be slight, but there may be considerable bleeding into the tissues.

2. *Incised* wounds. These are made by sharp instruments such as knives, glass, etc.

3. *Lacerated* wounds. These are accompanied by tearing of the tissue.

4. *Punctured* wounds. These are produced by pointed instruments or bullets.

Treatment.—If there is hemorrhage, control it (see page 633). When an incised wound has been made by a sterile object, the ends should be immediately brought into apposition. When such a wound is at all deep, it should be seen by a surgeon as soon as possible, for in such case there is great danger of infection. Deep wounds in which soil has become imbedded and wounds made with toy pistols are especially dangerous, because it is in such wounds that infection by the tetanus bacilli most frequently occurs. The reason for this was given in Chapter XX.

When the instrument or object causing the wound is unsterile, or the wounded part is dirty, syringe the wound with sterile salt solution and scrub the surrounding parts well with soap and water and a disinfectant. If there is any hair about the part remove it by shaving. Always examine such a wound for foreign particles, and wash out from it all blood-clots. Never close it entirely. As a rule, it is advisable to insert a small strip of gauze, catgut, or rubber tissue in its lower angle for drainage.

Before handling wounds, scrub and disinfect your hands. Be careful not to let anything unsterile come in contact with the wound. When sterile dressings cannot be obtained, the best substitute is a piece of soft, clean cheesecloth, cambric, or other thin white material over which a hot iron is passed several times.

Foreign Bodies in the Ears, Nose, Trachea, and Tissues.—Never poke at anything in the ear. If there is an insect in the ear, lay the patient down on the side opposite to the affected ear, pull the tip of the ear upward and backward, and syringe gently with warm water. Be careful not to close the orifice with the end of the syringe. For hard objects except such as will swell with moisture, syringe the ear with warm water. If the substance cannot be removed by syringing, medical aid had better be sought.

To remove lime or other soluble substance from the eye, bathe the eye with warm water. Insoluble substances, such as dust or cinders, can often be removed by drawing the upper lid down over the eye, and blowing the nose forcibly at the same time. If the particle is caught under the upper lid, instruct the patient to look down and inward, turn the lid back over a small pencil or knitting needle, being careful not to make pressure on the eyeball, and then, with the corner of a clean handkerchief, wipe off the offending object. If the particle is under the lower lid, draw the lid down against the cheek-bone and instruct the patient to look up. If it seems to be imbedded in the eyeball, do not interfere with it, but have the eye seen by an oculist at once, or permanent injury may result.

When any foreign substance gets into the nostril,

have the patient take a deep breath, close the mouth, press the other nostril, and blow the nose violently; the object may then dislodge. If it does not, make compression on the nostril above the object, and try to draw it out with a hair-pin or bent wire.

An obstruction in the throat, trachea, or esophagus may sometimes be removed by striking the patient forcibly on the back, between the shoulders. Sometimes it is expedient to invert him while doing so. A child can be held up by the legs; an adult should be placed across a bed, couch, or chair, with his head and chest hanging well over the edge. If the object is in the esophagus, it can often be washed down by a drink of water, or forced down by eating bread or other solid substance. To prevent excoriation of the alimentary canal, after the swallowing of any sharp substance, have the patient eat plentifully of bread, potatoes, or mush, but do not give a purgative.

To extract a barbed instrument, such as a fish-hook, from the flesh, push it sufficiently through to break off the head before drawing it back.

Hemorrhage.—Hemorrhage is the escape of blood from its containing vessels. When caused by a wound, it is called traumatic, but when it is due to a diseased condition of the blood-vessels, it is said to be spontaneous. According to the vessel from which the blood escapes, the hemorrhage is known as arterial, venous, or capillary. The variety will be recognized by the color of the blood and the manner in which it comes from the wound. In arterial hemorrhage, the blood will, owing to the contractive power of the arteries, be thrown out in jets or spurts corresponding to the heart-beats, and will be

a bright red color. In venous hemorrhage, it will be darker in color and will flow from the wound in a steady stream. In capillary hemorrhage the blood will ooze from the general surface of the wound, and not from any one point.

Hemorrhage occurring immediately after a wound or operation is known as primary, while that which comes on some hours or days afterwards is known as secondary. Secondary hemorrhage is generally caused either by the slipping of a ligature or by the sloughing of the tissues and blood-vessels.

Symptoms of Hemorrhage. — The symptoms are: a growing pallor; weak, shallow, sighing respiration, thirst; restlessness; a longing for fresh air; vertigo; a weakening of the pulse-beats, which also become rapid and irregular; a falling temperature; the presence of blood, except in the case of internal hemorrhage, when the escaping blood does not always come away immediately, and there are only the constitutional symptoms to indicate that a hemorrhage is taking place. These symptoms are due to the loss of fluid, oxygen, and heat sustained by the tissue cells and to the effect of the loss of blood upon the heart.

When the hemorrhage is from one of the larger arteries, death may occur in less than five minutes.

Nature of Treatment.—The aim in the treatment of hemorrhage is to further the physiological actions that take place when a blood-vessel is severed. These are: (1) Owing to the elastic nature of the walls of the blood-vessels, when a vessel is cut the severed ends contract and the caliber of the opening is thus reduced; (2) as soon as blood comes in contact with air it tends to coagulate; (3) the blood flows with less force, because the heart action is weakened. The

principal points of the treatment are: (1) to keep the patient quiet, mentally as well as physically, since excitement will increase the rapidity of the heart-beat as well as movement; (2) to avoid the use of heart stimulants until the hemorrhage has been controlled; (3) to place the wounded part in such a position that it will not get a large supply of blood; (4) to prevent the further escape of blood by pressure; (5) to, if necessary, use agents that will assist in the clotting of blood and in the contraction of the blood-vessels.

Position.—When the hemorrhage is from an extremity, elevate or flex the limb; when from the head, elevate the head of the bed; when from the abdomen, elevate the foot of the bed.

Pressure.—Pressure may be direct or indirect, and provisional or permanent.

Direct pressure is made directly over the bleeding point. This is done by bandaging tightly rolled compresses of gauze firmly over the wound, or, if the wound is deep, by packing it tightly with gauze before applying the compresses. The gauze, pressed against the vessels in this way, not only tends to control the hemorrhage by making pressure upon the bleeding vessels, but also helps in clot formation. Direct pressure, if the hemorrhage is from the larger arteries or veins, may not be sufficient; or it might be inadvisable to use it either because of the nature of the wound or the danger of infection. In these contingencies indirect provisional pressure must be made.

Indirect pressure is made over the large artery or vein which supplies the part. Pressure for arterial hemorrhage must be made between the heart and the bleeding point; for venous, it is first made between the periphery and the wound, and then above the

wound, to prevent the engorgement of the veins, or the entrace of air into them. This mode of pressure is called provisional, because it must not be continued for any length of time or gangrene will result. It can be safely continued for only one hour. It is made either by pressing the thumb or the fingers directly over the course of the artery or by applying a tourniquet or Esmarch bandage.

A tourniquet can be made of a handkerchief or a bandage of any kind. To prepare and use a tourniquet: Place some hard substance in the centre of the bandage or make a large firm knot in it, and put this over the course of the artery. Tie the bandage tightly. Introduce a stick, pair of scissors, or any similar object under the bandage, then turn, twisting the bandage until the bleeding ceases. When possible put a piece of cardboard or like substance under the bandage at this point, to avoid catching in the skin while twisting the bandage.

The Esmarch bandage is made of rubber. In applying it, make a few spiral turns around the extremity, pulling the bandage to its full extent. Leave a portion of the bandage rolled and slip the roll in under the last turn of the bandage, placing the roll over the artery. An ordinary piece of rubber tubing applied tightly and tied in a surgeon's knot will form an effective substitute.

To be able to make pressure without loss of time, it is necessary to know the course of all the large arteries. Nurses should therefore give this study careful attention and should practise stopping the arteries on each other. To do this, make pressure on the large arteries which supply the extremities with blood and then feel at the points below where the pulse can

usually be felt; if there is no pulsation in these arteries, the pressure is cffectual.

Hemorrhages from the scalp and face are usually easily controlled by direct pressure because of the underlying bones, but if necessary to control hemorrhage of the scalp by indirect pressure, make the pressure on the temporal arteries, where they can be felt pulsating a little above and to the back of the outer angles of the eyes. To control that of thc face, makc pressure on the facial arteries where they curve over the border of the lower jaw, just below the angle of the mouth, or before the ears, above the angle of the jaw. For hemorrhage of the axilla or of the shoulder, make pressure on the subclavian artery by pressing the fingers in behind the clavicle near its centre. For hemorrhage of the arm or hand, make pressure on the brachial artery; this can be best reached between the biceps and triceps muscles, or the inner surface of the arm, at the end of the upper third of the length from the shoulder to the elbow. Hemorrhage of the hand can also be controlled at thc wrist; pressure there must be applied on both the radial and ulnar arteries. Hemorrhage of the thigh can be arrested by pressure on the femoral artcry, either where it passes over the rim of the pelvis —viz., at about two thirds of the distance from the hip bone to the middle line of the body; the thigh, at the same time, should be flexed forcibly upon the abdomcn. For bleeding from the leg below the knee, pressure is made on the popliteal artery, behind the knee. This is best done by placing a pad behind the knee and flexing the leg forcibly backward, on the thigh. Hemorrhage of the dorsal surface of the foot can be controlled by pressure on the anterior tibial

artery at the instep; for bleeding from the sole of the foot, pressure is made on the posterior tibial artery just behind the inner malleolus.

An important thing to remember when removing pressure, either direct or indirect, is to do so slowly, for if it is done otherwise, the sudden rush of blood might dislodge the clot that has formed at the opening in the vessel.

After the amputation of a leg, as there is even more than the average danger of hemorrhage, either an Esmarch bandage or tubing should be kept near the patient's bedside for at least ten days.

Other Methods of Arresting Hemorrhage.—Other methods of arresting hemorrhage are:

1. The application of heat and cold. Heat coagulates the albumin of the blood and thus favors the formation of clots; it also contracts the arteries. An example of its use is: the hot douche (120° to 124° F.) in uterine hemorrhage. It must be remembered, however, that water used to control hemorrhage must be very hot; for a moderate degree of heat has exactly the opposite effect, it dilates the vessels.

Hemorrhage after Extraction of a Tooth.—This can usually be easily checked by placing a plug over the bleeding part and closing the jaws tightly. If this fails, moisten the plug in an astringent solution, such as adrenalin or strong tea. Cold contracts the arteries but interferes with the clotting of the blood. It is generally applied in the shape of ice or ice-water, either in ice-caps, ice-poultices, or ice-coils.

2. The use of astringents, such as acetic acid, adrenalin, and ergot. The acetic acid is added to hot douches, the ergot is given internally, and the adrenalin is employed both internally and externally.

3. The use of styptics, such as alum, gallic acid, and lunar caustic. Styptics are rarely employed now, because, although they are often efficacious in arresting hemorrhage, their action is deleterious to the tissue. Iron is sometimes used to arrest bleeding after extracting teeth and after slight operations such as tonsillotomy.

4. Ligation. The bleeding vessel is held by a pair of forceps while a ligature is tied around it.

5. Torsion. The artery is seized by the forceps and twisted. The twisting renders the use of a ligature unnecessary.

Epistaxis.—To check hemorrhage from the nose, have the patient remain quiet, apply cold to the back of his neck and compress the nostrils firmly. If this fail, it may be necessary to pack the nostril with a plug of cotton or other soft material. When the hemorrhage is severe, it may be necessary to moisten the plug with an astringent solution. Sometimes sponging the face and neck with very hot water will check nosebleed, because very hot applications will stimulate the vaso-constrictors of the area to which the application is made and those of the internal parts in reflex relation with it.

Hemorrhage from the Internal Organs.—In cases of hemorrhage from the internal organs, keep the patient quiet in a recumbent position, and, if the hemorrhage is severe, and uncontrollable, shut off the return circulation from the extremities by the application of tight bandages. Before beginning to bandage a limb allow it to hang down in order to get as much blood into it as possible. In applying these bandages, begin at the shoulders and the thighs. By thus giving the heart less fluid to pump, its contrac-

tions are weakened, and the blood, being sent with less force to the bleeding point, has a chance to clot at the ends of the vessels. One limb is always left unbandaged, the bandages being changed alternately, so that the circulation is not shut off from any one extremity longer than three quarters of an hour.

After the hemorrhage has been controlled, the bandages are often applied in the opposite manner—that is, the extremities are raised and the bandages applied, beginning at the periphery. This is done in this manner to keep the blood from the legs and arms and thus give the heart a larger supply.

Hematemesis.—The vomiting of blood is called hematemesis. The blood may come from any part of the alimentary canal, or from the respiratory organs. When it comes from the stomach, it is dark-colored, and sometimes has a coffee-ground appearance. Hemorrhage from the stomach is generally due to either ulcer or carcinoma of the stomach. In addition to the treatment already described, the patient must not be given food till ordered by the doctor. Crushed ice is often given.

Hemoptysis.—Hemorrhage from the lungs is called hemoptysis. It is easily recognized, as the blood is frothy by reason of the admixture of air.

Hematuria.—Blood in the urine is called hematuria. The blood may come from the kidneys, bladder, or urethra. When it comes from the kidneys, it is dark and clotted; when from the bladder, it is generally clearer.

Enterorrhagia.—Hemorrhage from the intestines is known as enterorrhagia. As in hematemesis, food must be discontinued until ordered by the doctor.

Uterine Hemorrhage.—In cases of uterine

hemorrhage, hot douches (120°–124° F.) are generally given, acetic acid being frequently added to the douche. Ergot is also generally given, either by mouth or hypodermatically, for its contractive effect upon the arteries. It is often necessary to pack the uterus. This is done by inserting either long strips of gauze, leaving the ends free, or tampons. The packing must be very tight, or it will be worse than useless. The greatest care must be taken when doing this; for, if the uterus is in such a condition that hemorrhage can occur, it will probably be easily perforated. Only in an extreme emergency, when other means had failed, would a nurse be justified in doing this. Everything used must be sterile.

Post-Partum Hemorrhage.—Hemorrhage following childbirth is called post-partum hemorrhage. In addition to the treatment described in the last paragraph, grasp the uterus through the abdominal wall and massage it vigorously. If the uterus has become so relaxed that it cannot be felt, knead the abdomen until the uterus contracts.

Hemorrhage from the Umbilicus and Umbilical Cord.—This form of hemorrhage is often very hard to control, because it is generally the result of some condition in the blood which interferes with its clotting. It rarely occurs, however, as an actual flow of blood, except when occasioned by improper tying of the cord, but is usually a persistent oozing, so that it is rarely necessary for the nurse to begin treatment before notifying the physician and receiving his directions. A common form of treatment is the application of compresses wet with adrenalin or subsulphate of iron. The compress is bandaged firmly over the bleeding point. If bleeding from the cord is

due to its improper tying, it must be retied with sterile tape.

Hemophilia.—This is a predisposition to hemorrhage that seems to be hereditary and is often transmitted from women who are not themselves bleeders to their male children. It is due both to the incapacity of the blood to coagulate properly, and to thinness of the walls of the blood-vessels. In persons thus afflicted the slightest wound may result fatally.

Shock.—All accidents of any severity are likely to be followed by shock, and it is often necessary to treat patients for this before even carrying out the specific treatment. Shock is a partial or complete prostration of the vital forces. Its symptoms are a weak and irregular pulse; irregular, sighing respiration; mental and muscular weakness, pallor, and a cold exterior. The temperature is subnormal at first, but pyrexia is apt to follow. The patient may or may not be unconscious. Complete unconsciousness is an unfavorable symptom. Vomiting, on the other hand, is a favorable one, since it shows that the nerve centers are not completely prostrated. As stated in Chapter XX, the symptoms of shock are about the same as those of hemorrhage; because, owing to the relaxed condition of the arterial walls that occurs when the nervous system is depressed, the blood collects in the large vessels of the abdomen and internal organs. Consequently, the tissues are deprived of blood and the same conditions occur as in hemorrhage.

Treatment.—To treat shock, loosen all clothing, elevate the foot of the bed, apply heat, and give plenty of fresh air. In severe cases, morphine is given, the extremities are bandaged, and small sandbags placed

on the abdomen to prevent the blood accumulating in the abdominal vessels. It must never be forgotten that the symptoms of shock are not always obvious immediately after an accident. The excitement caused by the event often acts as a strong stimulant for the time being. Therefore, after any severe accident keep the patient quiet and warm or a sudden collapse may follow.

Medical Emergencies

Apoplexy.—Apoplexy is generally due to pressure on some part of the brain caused by hemorrhage from one or more of the cerebral blood-vessels. There is usually a sudden loss of consciousness, the face is usually flushed, and the pupils of the eye are fixed, one or both of them being dilated. The pulse, as in the majority of cases where there is brain pressure, is full and slow. The respirations are slow, labored, and stertorous. There will be paralysis, usually hemiplegia. Convulsions and vomiting also may occur.

Treatment.—To give first treatment to a victim of apoplexy, loosen his clothes, elevate his head and chest, and apply ice to his head and warmth to his extremities. Do not give stimulants.

Asphyxia.—Asphyxia is caused by a great diminution of oxygen in the blood, due to the impurity of the air, to cessation of respiration, or to an obstruction to the passage of air to the lungs.

Treatment.—If the asphyxia is due to the last cause, remove the obstruction if possible. In all cases, give plenty of fresh air, loosen the clothing, and dash cold water over the face and chest unless the body is cold, when hot applications should be

used. If necessary, perform artificial respiration and treat for shock. Cessation of breath for longer than two minutes is usually fatal.

Artificial Respiration.—There are two methods of giving artificial respiration in common use, namely, Sylvester's and Marshall Hall's. To employ either method, the tongue must be first drawn forward and held so. If there is no assistant to hold the tongue out, tie a handkerchief or string around it, cross the ends, pass them round to the back of the neck, and tie them there.

If you use Sylvester's method, lay the patient on his back with his head and shoulders slightly elevated. Then, standing behind him, grasp his arms above the elbows and draw them slowly outward and upward till they meet over his head. Hold them in this position for two seconds and then flex them slowly but forcibly against the sides of the chest. The first motion causes inspiration, the second, expiration. The combined movements should be repeated sixteen times in a minute until respiration takes place naturally, or until all hope of resuscitating the patient has been abandoned. Resuscitation should not be considered hopeless until artificial respiration has been practised at least two hours.

When Marshall Hall's method is used, the patient is placed upon his face with a cushion or roll of clothes under his chest, and pressure is made upon his back. He is then turned upon his side. After a few seconds, he is turned upon his face again, and pressure is reapplied upon his back. These movements are repeated sixteen times in the minute.

The December number, 1907, of the *American Journal of Nursing* included the following description

of a new and very simple method of artificial respiration which was devised by Prof. E. A. Schaefer of Edinburgh:

"Lay the patient prone (on his chest), the head turned slightly sideward, the tongue protruding from the mouth. Kneel by the side of, or across, the patient. Place your hands flat upon his back over the lowest ribs, and, with the weight of your body, press firmly and gradually so as to expel the contents of his lungs. Then relax the pressure by swinging your body slowly up without removing your hands. The patient's chest resumes its former dimensions, and the fresh air is thereby drawn into the lungs. Repeat these movements of pressure and relaxation about every five seconds, not oftener."

Collapse.—This condition is the same as shock. The word collapse being generally used when the prostration is due to disease, and shock when it is the result of accidents or following operation.

Convulsions.—Convulsions in adults are generally due to epilepsy, hysteria, uremia, poisoning from drugs, or bacteria. The different types of convulsions were discussed in Chapter VIII.

Treatment.—To deal with a victim of convulsions: Keep him from hurting himself, but, beyond this, do not try to restrain his movements. Put something between the teeth to prevent him from biting his tongue. Loosen his clothing. Maintain him in a recumbent position, with the head slightly elevated. Give plenty of fresh air, but not stimulants. The further treatment depends upon the cause of the convulsion.

Convulsions in children are more common than in adults, and may mean little or much. They are often

due to difficult dentition, excitement, indigestion, or worms. They also frequently usher in many serious diseases, particularly the exanthemata. Put the child in a hot bath 112°–118° F. (see Chapter XI). Give an enema and, if possible, a dose of castor oil.

Drowning—When you have to deal with a person who has been rescued from the water in an unconscious condition, artificial respiration is generally necessary, but, before starting this, loosen his clothing, turn him face downward, raise his body at the waist-line, to favor the emptying out of water from the trachea, and then clean out any accumulation of mucus from the back of his throat. As soon as possible, remove his wet clothes, put him between warm blankets, and otherwise treat for shock.

Fainting.—Fainting, or syncope, is a state of unconsciousness caused by a decrease in the amount of blood sent to the brain. This may be due:

1. To some form of heart disease.

2. To temporary weakness of the heart by exhaustion, as in extreme hunger, prolonged, excessive exertion, or even a slight amount of exertion if the person is in a weak condition.

3. To anything strongly influencing the nervous system. The action of the heart being to a great extent under the control of the nervous system, anything tending to affect strongly the latter (pain, fright, or excessive emotion, for example) may bring on an attack of syncope.

As the brain becomes anemic in syncope, one of the first things to do is to lower the head. In fact, if a person threatened with syncope bends forward, when he first feels dizzy, so that his head will be lower than his knees, or lies down, keeping his head

low, the attack will often be averted. Fresh air should be supplied in abundance and all clothing should be loosened. Cold water, thrown over face and chest, will, by causing enforced inspiration, often shorten the attack. Smelling salts or ammonia may be given by inhalation, but care must be taken in using the latter, not to let any drop into the eyes, and not to hold it too near the nose or mouth, as an intense irritation of the air passages may result.

After a patient has recovered from an attack of syncope, keep him quiet until the proper action of the heart and circulation is re-established.

Symptoms of Syncope.—In syncope, the face is pale, the pulse weak and somewhat accelerated, and the respiration shallow. The attack is generally of short duration.

Hysteria.—One of the common forms of hysteria is a simulation of syncope. In the former, the patient is not unconscious, he will resist any attempt made to raise the eyelid, and there will be little, if any, change in his color, or in the rate and quality of his pulse-beat. The same facts are true of hysterical convulsions, and in these the patient seldom hurts himself. Hysterical patients should be watched, but, as a rule, the best treatment is to leave them alone.

Intoxication.—The stupor of intoxication is often confounded with apoplexy, and, worse still, *vice versa*. In the former, the patient's pupils are generally evenly dilated, he can usually be partially aroused, and his breath smells of alcohol. Too much weight must not be placed upon the last symptom, however, because, previous to an attack of apoplexy, uremia, or diabetic coma, the patient may feel indis-

posed and take some form of alcohol for medicinal purposes.

Poisons. — According to their action, poisons are classified as:

1. *Corrosives*, which corrode and burn the tissues.
2. *Irritants*, which irritate the tissues.
3. *Neurotics*, which affect the nervous system.

Treatment.—The treatment for poisons has three objects in view: to remove the injurious substance; to neutralize its further action; and to remedy the ill effects already produced. The first object is attained by the giving of lavage or an emetic. The second object is attained by giving a chemical antidote, which must be a substance that will, by acting chemically upon the poison, produce a compound which is either insoluble or comparatively harmless. Acids are always given for this purpose when alkali poisons have been taken, and alkalies when the poisoning agent is an acid, for acids and alkalies combine to form what is usually a harmless salt. Tannin—this can be used in the form of strong tea—will precipitate nearly all the alkaloids and, therefore, is often used in the treatment of poisoning by drugs of this class. The precipitate formed is not always very stable, therefore lavage must be repeated after giving the chemical antidote; in fact, it is generally well to give both tannin and lavage alternately, two or three times. The treatment resorted to for the attainment of the third object is known as the physiologic treatment. It consists in such treatment as will counteract the effect of the poison upon the system; *e. g.*, treatment for shock will be always necessary; after poisoning with corrosive substances, demulcent drinks will be required; after poisoning by neurotics that excite the

nervous system, extreme quiet will be imperative; after poisoning by neurotics that are nerve depressants, the patient must be kept awake. An important thing to remember with regard to the treatment of poisoning is that treatment must be begun promptly, since many drugs are absorbed from the stomach or intestines very readily.

Formerly emetics were always given except after corrosive poisons, but it has been found that emesis produces such marked prostration that emetics are no longer used when it is possible either to wash out the stomach or to remove its contents with a stomach pump. In emergency when there is no stomach tube to be had, any rubber tubing of small caliber—*e. g.* that on a fountain syringe bag—can be used. Emetics are never given after poisoning by corrosive poisons, since the tissues of the esophagus would be further corroded during emesis; lavage is given when there is not sufficient abrasion of the mucous membrane to prevent the passing of the tube. The emetics most commonly used are:

Sodium chlorid (salt)—two teaspoonfuls in a glass of water, repeating the dose several times, if necessary.

Mustard—one or two teaspoonfuls in a glass of water.

Apomorphine—gr. one-tenth to one-eighth, given hypodermatically.

Ipecac—m. xxx of the fluid extract.

Sulphate of zinc—grs. xx to xxx.

These are all adult doses. For a child's dose, see Chapter XVII.

Tickling the back of the throat with the finger will usually produce emesis.

The following table gives the symptoms of the

more common poisons and the chemical antidotes and physiological treatments frequently used.

Poison.	Symptoms of Poisoning.	Chemical Antidote.	Physiological Treatment.
Corrosive Acids: Acetic. Citric. Hydrochloric Nitric. Sulphuric.	Corrosion of the mucous membrane, intense abdominal pain, livid, cold skin, small, irregular pulse, stupor, collapse. There may be convulsions.	Alkalies, soda, magnesia, chalk, lime-water.	Demulcent drinks, as oil, milk, and albumin, stimulants, opium, external heat.
Oxalic.	As above.	Chalk or lime. Neither potash nor soda can be used, since their oxalates are poisonous.	As above.
Carbolic.	As above. Also odor of carbolic in breath, vomitus, and urine. Strangury and, sometimes, retention of urine. Smoky urine.	Sulphate of magnesia, sulphate of soda, lime-water, syrup of lime, and alcohol.	As above, but give no oil since oil hastens absorption. Catheterize.
Hydrocyanic Acid.	Almost immediate loss of consciousness, eyes protruding and showing pupils dilated, pulse imperceptible, respiration very slow, odor of acid on the breath.	Acts too quickly for any antidote to be of use.	Artificial respiration, cold water to head and spine, stimulants, external heat.
Corrosive Alkalies: Ammonia. Caustic Potash or Soda Potassium Nitrate. Calcium.	Excoriation of tissue, violent abdominal pain, vomiting and purging of bloody matter. Usual symptoms of collapse.	Mild acids—vinegar or lemon juice, sour cider.	Heat, stimulants, milk, oil, white of eggs for ammonia. Cold air, artificial respiration.
Irritants: Antimony.	Epigastric pain, shrunken features, cramps of lower extremities, convulsive spasms, collapse.	Tannic acid, strong tea.	Demulcent drinks, heat.
Arsenic.	Puffiness and itching about the eyelids, intense abdominal pain, violent vomiting, hiccough, intense thirst, straining, stools bloody and offensive, collapse, sometimes convulsions.	Iron. Common preparations of iron used for this purpose are: (1) Tersulphate of iron in a strength of one part iron to four of water. Mix two ounces of this with eight of a 1% solution of magnesium carbonate. Let it remain in the stomach fifteen minutes; then wash out stomach. Repeat	Demulcent drinks, heat, stimulants if necessary. Catheterize.

Poison.	Symptoms of Poisoning.	Chemical Antidote.	Physiological Treatment.
		two or three times. (2) Tincture of iron hydrated with sufficient ammonia to deposit the iron in a thick sediment; the sediment, then, to be washed by putting it in a fine strainer lined with gauze and pouring water over it. Mix a tablespoon of the precipitate with milk or water. Repeat the dose at intervals. Eight grains of the iron are required to neutralize one grain of arsenic.	
Bichloride of Mercury. Calomel. Blue Mass.	Salivation, metallic taste, mucous membrane sometimes glazed and white, vomiting of blood and mucus, tenesmus, dysenteric purging, diminishing urine. Collapse after a short time and convulsions.	White of egg in water. One egg to every four grains of mercury.	Copious mucilaginous drinks, heat, stimulants if necessary, milk and flour paste.
Iodine.	Pain and burning of alimentary canal, vomiting, purging, yellow stain about mouth.	A paste of starch or flour and water.	As for bichloride of mercury.
Lead.	Slate colored lines on the gums along margin of incisor teeth, colic, and other symptoms of irritant poisons, paralysis of extensor muscles of forearms.	Sulphate of sodium or magnesium, white of eggs, and milk.	As above.
Phosphorus.	Odor of garlic in breath, "coffee-ground" vomitus which is luminous in the dark; jaundice and usual symptoms of irritant poisons.	Crude French acid turpentine, in ℥ss doses every 15 minutes. Use sulphate of copper as emetic. Give purgatives. Never give oils, since they hasten absorption.	As above.

Poison.	Symptoms of Poisoning.	Chemical Antidote.	Physiological Treatment.
Gases.	Embarrassed respiration, frequent, weak, irregular pulse, cyanosis, dilated pupils, loss of sensibility in the conjunctiva.		Loosen all bands, lower head, heat, stimulants, fresh air, artificial respiration. Keep tongue forward. After illuminating gas, phlebotomy is often performed.
Neurotics: Aconite.	Characteristic tingling, pulse irregular, intermittent, and slow, respirations shallow, weak, sighing, and slow, anesthesia of the surface, anxious expression, eyes glaring, dilated, and protruding. The mind is usually clear, but there are often convulsions. (Acute poisoning.)		Atropine, digitalis, heat, keep head low, artificial respiration.
Alcohol.	A short period of excitement followed by coma, respirations irregular and stertorous, pupils either dilated or contracted, face flushed, pulse frequent and hard.		Heat to extremities, cold applications to head, inhalations of ammonia.
Belladonna.	Dryness of mucous membrane and skin, general rash resembling that of scarlet fever, pupils dilated and staring, headache, vertigo, restlessness, and noisy delirium.		Catheterize frequently, hot mustard baths, cold affusion to head, artificial respiration.
Digitalis.	Pulse irregular, slow, weak, and out of proportion to the heart-beat, headache, face pale, eyes staring and prominent. Sclerotics blue, vomiting, great prostration, rapid respiration, convulsions.	Tannin.	Strychnine, keep patient quiet and in horizontal position.

Poison.	Symptoms of Poisoning.	Chemical Antidote.	Physiological Treatment.
Chloral.	Respiration slow, irregular, and shallow, pulse first weak and slow, then rapid, irregular, and thready, coma, almost complete relaxation of the muscles, pupils contracted and then dilated.		Alcoholic stimulants, strong coffee, mustard pastes, hot foot-baths, electricity, heat.
Hyoscyamus.	Either deep sleep and unconsciousness, or noisy delirium followed by coma, intense thirst, dilated pupils.		Same as belladonna.
Nux Vomica.	Tonic convulsions, face livid, mouth contracted,—"risus sardonicus,"—eyes open and staring. Death is usually the result of paralysis of the respiratory muscles.	Tannic acid or tincture of iodine. Follow immediately by emetics, as compounds thus formed are not permanent.	Absolute quiet, bromide, chloral, or chloroform for convulsions; catheterize to prevent reabsorption.
Opium.	Intense desire for sleep, respiration slow and stertorous, contracted pupils, face first flushed, then pale, pulse at first full, slow, and strong, but gradually becoming rapid and weak, profuse perspiration. Retention of urine is frequent.	Potassium permanganate. Use for lavage.	Keep patient awake, artificial respiration, atropine if necessary, strong black coffee by rectum and mouth. An important thing to remember in regard to opium poisoning is that the lavage must be frequently repeated, even when the drug has been taken hypodermatically; for opium is alternately absorbed from, and excreted into, the stomach, so long as it is in the system.

Ptomaine Poisoning.—Due to putrefying foods. Symptoms: A few hours after eating the poisonous food, there will be nausea; abdominal pain, and, usually, purging; followed by faintness; weak pulse; cold, moist skin; thirst; and, in some individuals, a bright red rash.

Treatment.—Emetic; lavage; heat, especially to the abdomen; stimulants if necessary, and, later, a large dose of castor oil.

Mushroom Poisoning.—Symptoms: Nausea, vomiting; colic; diarrhea; weak pulse; labored breathing; cold, moist skin. The pupils are at first contracted but later become dilated. These symptoms, unless relieved, are followed by collapse and, at times, by paralysis.

Treatment.—Empty the stomach; apply heat; apply hot fomentations to the abdomen; stimulate. Atropine is often used. Later give a large dose of castor oil.

Local Poisoning from Poison Ivy.—In a case of ivy-poisoning, envelop the poisoned part in clean white cloths wet with a solution of bicarbonate of sodium.

Poison from Bites or Stings of Insects, Snakes, etc.—The poison of the majority of insects, such as bees, spiders, etc., consists largely of formic acid; therefore, to relieve the irritation following a sting, use an alkali, such as ammonia water or a saturated solution of soda. In a case of poisoning from the bite or sting of a snake or other venomous creature, if the wound is on one of the limbs, apply a tight bandage above the point of injury to shut off the return flow. Leave the bandage on for about one half hour; then loosen and remove it gradually—the effects of the poison are not so severe when it enters the system slowly. Other items of the treatment are: unless bleeding can be caused, to induce it by making a slight incision, to apply a cupping glass over this, and to cauterize the wound with silver nitrate or other caustic, the heated point of a knife or other

implement. Formerly, alcohol in the form of whisky or brandy was given in large quantities, but this is not considered to be of any value. The treatment of bites by mad dogs is considered under Hydrophobia, Chapter XXV.

SUNSTROKE.—Sunstroke, called also *insolation*, is marked by unconsciousness, stertorous breathing, a weak and fluttering pulse; the face is usually congested and there may be convulsions; there is extreme hyperpyrexia—the temperature frequently rising to 110° F. and over.

Treatment.—To treat a sunstroke, apply ice to the head and give ice-cold baths with constant friction till the temperature drops. As death may occur any moment from heart failure, watch the pulse carefully, and take the temperature every five minutes. When it drops markedly, remove the patient from the bath, apply heat to the extremities, and give stimulants when necessary. Renew the cold applications, if the temperature rises.

Heat prostration is a mild form of insolation. To treat it, apply ice to the head, give cold baths if necessary, rubbing constantly, and keep the patient quiet.

Sunstroke and heat prostration can be caused by intense heat of any kind. Exposure to the direct rays of the sun is not essential. Fatigue, foul air, and alcoholism will aggravate the danger.

CHAPTER XXV

A SYNOPSIS OF SOME OF THE MORE IMPORTANT DISEASES

Theories of the Cause of Disease. Causes of Disturbances of Cell Activities. Heredity as a Factor in Causing Disease. Nature of Toxins. Means of Preventing Disease. Nature of Antitoxins. Nature of Immunity. Classification of Diseases. Stages in Infectious Diseases. Disinfection and other Prophylactic Measures Necessary to Prevent the Spread of Infectious Diseases. Causes and Nature of Some of the More Common Diseases, and the Necessary Nursing Care.

Theories of the Cause of Disease.—That an evil spirit entered into and possessed the body is the earliest known theory of the cause of disease. The restlessness and delirium of fever were supposed to be due to the individual's endeavor to escape from the clutch of a malicious, but invisible, power. The aim of the treatment was to disgust the demon with his quarters; hence, it consisted in shaking the patient, in giving him bitter doses, in beating tom-toms and making every conceivable kind of noise. The theory of demoniacal possession exists to this day among savage tribes. In the races that laid the foundation for our present civilization, however, it was abolished as early as the time of Hippocrates, a Greek physician who lived B.C. 468–367. Hippocrates formulated the theory that the body contained four humors or

vital fluids, viz., the blood, phlegm, yellow bile, and black bile, and that health depended upon the presence of these humors in proper proportion, and disease on their improper mixture. This theory dominated all civilized countries until the seventeenth century, when various others were advanced. Disease, some authorities then claimed, was a lack of natural stimulus; others said that it was nature's attempt to rid the body of morbific matter. The influence of the latter conception is seen to the present day in the dread that many persons have of doing anything that they think will check, or, as they usually express it, *drive in*, the eruption of measles and other eruptive diseases. Hahnemann, a German physician, who lived between 1755 and 1843, and was the founder of the homeopathic school of medicine, said that disease was *a spiritual dynamic derangement of a spiritual vital principle. He also claimed that medicine gained in strength by being diluted.* Though his ideas were confused and erroneous, they had a beneficial effect upon medical treatment, for his practical application of them showed that the sick thrived better without medicine than with the large and indiscriminate doses customary at that time and for many years later. Virchow, a German anatomist and anthropologist, who lived between 1821 and 1902, was the first to advance the cellular theory. This holds that *disease is the result of disturbance of the vital activities of some of the individual cells of which the body is composed.* This and the germ theory of disease, which owed its origin to the germ theory of fermentation, originated by Pasteur (see Chapter II), are the theories held at the present time.

CAUSES OF DISTURBANCES OF CELL ACTIVITIES.—

These are many—among the most common are: lack of proper nourishment of the body cells; lack of oxygen, overwork, or lack of exercise of the body as a whole or of some one organ of the body; irritation of any of the body cells by poisons, either those taken into the body or those produced within the body (1) as the result of lack of proper elimination of waste matter, (2) by interference with digestion or metabolism, or (3) by bacteria; inhalation of various hurtful substances used in certain trades, as, for example, arsenic, phosphorus, chromic and oxalic acid, mercury and its salts, coal dust, the dust developed in making pearl buttons and many other objects; exposure to extremes of temperature or other abnormal atmospheric conditions; injury due to accidents or violence.

Predisposing Causes of Bacterial Diseases.—Diseases due to germ invasion are more easily acquired when body resistance is lowered in any way; *e. g.* by any other disease, by cold or fatigue.

Heredity as a Factor in Causing Disease.—Until recent years, quite a number of diseases were thought to be inherited, by inheritance being understood *present in the cells from which the embryo is developed.* The present opinion, however, is that few diseases are directly inherited as such. Children born of a woman suffering with syphilis are more than likely to have the virus in their blood, in consequence of which the disease will develop a few days after birth, but, in such case, the word congenital—*i. e.*, born with—is substituted for the term hereditary, since it is not hereditary in the true acceptance of the word. If a woman has gonorrhea of the genitalia when her child is born, the latter will almost certainly

have the disease, but it will be contracted during parturition. The child of tuberculous parents is likely to acquire tuberculosis because, unless proper precautions are exercised, it will be constantly exposed to infection, and if the mother had tuberculosis during pregnancy the chances are that the child was not properly nourished during intra-uterine life and consequently will be delicate and predisposed to infection.

Toxins.—A large proportion of the symptoms characteristic of infectious diseases are due to the toxins produced by the bacteria. The toxin produced by each species of microörganism differs and consequently produces different symptoms, also many of the toxins affect special parts of the body more strongly than others. For instance, the toxins of the tetanus bacillus attack specifically the nervous system, the toxins elaborated by the streptococci and staphylococci primarily attack the red blood corpuscles. A fundamental difference between toxins is that some toxins are soluble, secretory products of the bacteria and pass from the bacterial cells into the media in which they are growing—whether the media be the animal body or the culture media of the laboratory. Such toxins are known as *true toxins*. Of this nature are the toxins of diphtheria and tetanus. The poisons produced by other species of bacteria, on the contrary, are not excreted into the media, but remain attached to the microörganisms. These are known as *endotoxins*. The toxins produced by the typhoid bacillus and the cholera spirillum are of this nature.

Means of Preventing Disease.—Disease is prevented by both voluntary and involuntary means. The voluntary means consist in providing the body

with sufficient and proper nourishment, and an adequate supply of fresh air and sunlight; avoiding excessive fatigue or constant overworking of any one part or organ of the body; keeping the excretory organs of the body active so that there will be no accumulation of waste matter in the body, and, for the same reason, keeping the system properly flushed by drinking sufficient water; avoiding becoming excessively overheated or chilled, and training the body to react promptly to the sudden alterations of external temperature by taking cold baths; living in clean surroundings—damp, dark, dirty places favor the development of almost all kinds of pathogenic bacteria. In addition to these prophylactic measures that each individual must see to for herself there are others that may or may not be under one's personal control; for instance, the prevention of the contamination of water, and of milk and other food, before it is purchased, by flies, fleas, defective sewerage, and the like.

The involuntary measures of preventing disease are those which nature provides. These are: (1) the hydrochloric acid which is secreted by the stomach; (2) the alkaline digestive juices present in the intestine; (3) the antitoxins, phagocytes, and other bactericidal substances present in the blood.

Nature of the Antitoxins in the Blood.—From earliest times it has been a well-known fact that an attack of any one of the infectious diseases usually rendered a person immune from a second attack of that special disease; but the reason for this immunity was in no wise suspected until after the discovery that such diseases were due to microörganisms, and it has been only within very recent years that even a

partial understanding of the reason for such immunity has been attained. The most generally accepted theory of the present day is that advanced by Professor Ehrlich, which, not to go into details, is about as follows: The cells of the animal body contain certain chemical substances that Professor Ehrlich names *cell-receptors*, which have the power of taking the material which they require for their nourishment from the blood and lymph. These cells combine also with bacterial substances, but these, unlike the food molecules, destroy the receptors. Unless the injury is carried too far, however, not only will the regeneration of the receptors take place, but a supply in excess of the cells' needs will be formed and the surplus be discharged into the blood-stream. These free receptors remain in the blood and, later, if the microörganisms of the disease to which these cells owe their origin enter the body the receptors will unite with the toxins and so prevent their union with the tissue cells.

In addition to the antitoxins, substances that will destroy bacteria are developed in the blood as the result of some infections; examples are agglutinin—this will cause agglutination or coherence of the bacteria (see Widal test, page 76)—and precipitin, which precipitates bacteria. Other defensive substances always present in the blood are the phagocytes, which have been referred to in connection with inflammation, and opsonins. The latter are chemical substances which, in some as yet unknown manner, so act upon bacteria that the phagocytes can more easily destroy them. They were named *opsonins* for this reason, the name being derived from a Greek word signifying *I prepare food for.*

Nature of Immunity.—By immunity is meant, security against any particular disease. Immunity is said to be either *natural* or *acquired* and acquired immunity may be either *active* or *passive*. By natural immunity is meant the resistance which some animals have against certain diseases, *e. g.* all animals will not contract the same diseases as man and man will not become infected by some diseases that will spread rapidly among cattle. Also, some races are much more susceptible to certain diseases than others. The reason for this is not understood, but it is a well-known fact that races among whom an infectious disease is newly introduced are more severely attacked than races among whom it has been endemic for many ages. For instance, the American Indians, negroes, and Esquimaux have been ravaged by tuberculosis in a way that other nations never have; and the inhabitants of those tropical lands in which yellow fever and malaria are endemic are not subject to severe attacks or epidemics of these diseases as are those who go to those countries from other lands.

The reason for the difference in the degree of susceptibility between different species of animals is thought to be largely due to the differences in body temperature and the various metabolic differences that exist in distinct species of animals. The causes of natural individual immunity are various and include general health and the degree of observance of proper hygienic methods.

Acquired immunity is immunity that has been gained either by an attack of the disease or by the introduction into the body of antitoxins that have been formed in the body of some other animal. When immunity is gained from the former cause it is

spoken of as *active immunity*, when it is due to the latter, it is called *passive immunity*. This was discussed in Chapter XXII.

Classification of Diseases.—The fundamental classes under which diseases are considered are infectious or communicable and non-infectious. Infectious or communicable diseases are those which can be transmitted from one person to another; they are caused by parasites such as bacteria, protozoa, or fungi. Formerly, the more readily communicable diseases, as scarlet fever, measles, and smallpox, were called *contagious diseases*, but as this classification was indefinite and misleading it is no longer used. Several of the infectious diseases are sometimes classified as *acute infectious diseases of unknown origin* because, though the manner of their transmission leaves little doubt but that they are due to microörganisms of some kind, no specific organisms have as yet been isolated. Important diseases belonging to this class are scarlet fever, measles, German measles, smallpox, chicken-pox, mumps, whooping-cough, yellow fever, dengue, typhus fever, beriberi, and hydrophobia. The five diseases, scarlet fever, measles, German measles, chicken-pox, and smallpox, are classed as the *acute exanthemata* or *acute eruptive fevers*, because of the specific rashes, which are one of their most characteristic symptoms. Diseases such as typhoid, cholera, and amebic dysentery, which are often transmitted by drinking water, are sometimes classed as *water-borne diseases;* and diseases of which the causative microörganism is contained in matter that is likely to be scattered about so that the infection can be carried in the air are sometimes called *air-borne diseases*.

Non-infectious diseases are usually divided into local—those in which the principal seat of the disturbance is in some one organ—and constitutional—those which affect the whole constitution or body. Important diseases which are so classed are: diabetes mellitus, diabetes insipidus, gout, rickets. Certain non-infectious diseases, as endocarditis and rheumatism, are due to bacteria.

Infectious Diseases

Terms Used in Describing the Degree of Prevalence of Infectious Diseases.—When a disease attacks many people at the same time it is said to be *epidemic*. An epidemic which spreads over the greater part of the world is said to be *pandemic*. A disease that is found almost constantly in any given locality is said to be *endemic*. Cases of disease which occur singly and independently of any discoverable source of infection are called *sporadic*.

Common Causes of Epidemics.—Wherever many people are living together in close quarters, epidemics are likely to occur, and the chances are increased when the surroundings are unhygienic or the people improperly fed, exposed to hardships of any kind, or suddenly transported to a climate to which they are not accustomed. Water and milk are common causes of epidemics. Numerous epidemics of typhoid have been traced to infection of the water supply of a locality by the excreta of a patient suffering with the disease; the excreta having been emptied into a privy vault without disinfection. In some cases the privy has been at quite a distance from the water, but in some soils fluid excreta and bacteria soak through

the earth much farther than would be deemed possible. Epidemics of typhoid, scarlet fever, and diphtheria traced to a milk supply have been often found to be due to washing the milk cans in infected water, or to the handling of the milk by persons who are suffering from a mild attack of the special disease or who have had it and recovered, but still have the germs in their throat or intestines, as the case may be, or who are helping nurse or otherwise coming in close contact with individuals who have the disease. Milk is a particularly common vehicle of infection, because it is a substance in which bacteria develop exceedingly rapidly. Epidemics of typhoid have been traced also to oysters that were fed in water into which the sewerage of the locality emptied. Flies are thought to be a common source of infection, for flies caught in the house of patients suffering with typhoid and examined under the microscope have been found to have their stomach, feet, and wings infested with typhoid bacilli. The epidemics of typhoid that occurred in almost all the camps of United States soldiers during the Spanish-American War are thought to have been largely due to flies. As Dr. Woods Hutchinson writes: "The fly *breeds in dirt and it feeds on food, and, as it never wipes its feet, the interesting results can be imagined*."[1] Epidemics of malaria and yellow fever are due to marshy localities which afford a breeding place for the *anopheles*—the mosquito which acts as a host for the malaria organism—and the *stegomyia fascita*—the mosquito which acts as a host for the yellow fever organism. Epidemics of the bubonic plague have been caused by fleas and rats.

[1] *Preventable Diseases*, p. 210, Woods Hutchinson, A.M., M.D. Houghton Mifflin Company.

Paths through which the Organisms Causing Disease Enter the Body.—One important factor in determining whether disease will follow the entrance of bacteria into the body or not is, in the case of many species of organisms, the path through which they enter; for example, the bacteria which cause pneumonia, diphtheria, and influenza must enter the respiratory organs; those causing typhoid fever, dysentery, and cholera, the alimentary tract; those causing malaria, yellow fever, and hydrophobia must enter the blood by inoculation; those causing tetanus, septicemia, and wound infection enter through abrasions in the skin or mucous membrane.

Methods of Transmission of Infection.—Those diseases due to invasion by bacteria which gain entrance to the body through the alimentary canal are usually transmitted by water, milk, uncooked food—as green vegetables that have been watered with infected water and fruit upon which infected flies have rested. The infectious diseases that affect the respiratory tract are usually contracted by touching articles that have been soiled with sputum or nasal discharge containing the special organisms and, later, putting the hands to the mouth, or by breathing in dust containing the organisms before they have been rendered harmless by drying. Syphilis, gonorrhea, the acute eruptive fevers, and leprosy are contracted by contact with the patient or fomites—*i. e.* substances that absorb and transmit contagium. Hydrophobia is contracted by the bite of an animal infected with the disease. Malaria and yellow fever result from bites by the mosquitoes which act as intermediate hosts for the organisms that cause the diseases. The mosquito is said to act as an intermediate host, because it

affords an abiding place in which the organism can develop. When the mosquito bites an individual who has the malarial organism in his blood, it sucks in with the blood it withdraws many of the malarial parasites, and the sexual forms of these develop in the body of the mosquito and in a few days split up into numerous small protozoa, which the mosquito introduces into the blood of the next individual whom it bites. The specific organism of hydrophobia is transmitted from an animal suffering with the disease to man or another animal in the saliva with which it inoculates the victim of its bite.

Necessary Precautionary Measures against Infection.—In order to prevent the occurrence of epidemics it is most important that wherever even one person is suffering from an infectious disease proper precautionary measures be taken. These will consist in keeping the surroundings clean and, as far as possible, exposed to the sunlight; in covering all infected matter that cannot be at once disposed of, so that flies will not light upon it, and keeping flies out of the sickroom; in careful disinfection of all material, utensils, and places in which it is possible for the germs to gain access; and disinfection of the excreta known to contain the germ is of the utmost importance. This is more especially the case in country places where the excreta are emptied into a privy vault; because, as already stated, in some soils the infective material may be carried quite a distance. The measures necessary to rid a locality of yellow fever and malaria are (1) to screen all patients suffering from such diseases so that mosquitoes will not be able to bite them and thus be provided with the means of inoculating other people; (2) to screen the

doors and windows of all houses; and (3) to prevent the breeding of mosquitoes. As the *anopheles* and *stegomyia* breed only where there is standing water in which there are no fish to eat their eggs and in which their larvæ have access to the air, they can be prevented breeding by draining swampy places, or, when this is impossible, pouring crude petroleum over the water and thus forming a film upon it which prevents the access of air to the larvæ, and by stocking ponds and pools with fish. It was largely by these means that Colonel Gorgas, doctor in the United States Army and Chief Sanitary Officer in Panama during the construction of the canal, changed the death-rate in the Canal Zone from about the highest to one of the lowest in the world, the previous enormous death-rate having been due to the epidemics of yellow fever and malaria that occurred when strangers went in any number to the Isthmus.

Degree of Disinfection Required.—The amount and nature of disinfection in and at the close of communicable diseases depends upon the nature and virulence of the infection and whether or no the spread of the infective material can be prevented. In the case of diphtheria and the exanthemata, except German measles and chicken-pox, the infection may be very virulent and prevention of the spread of infection, except in diphtheria, is difficult. Therefore, in these diseases isolation of the patient is essential. In the other communicable diseases isolation is not necessary, but the following precautions are imperative:

The discharges and excreta containing the germ should be either burned or disinfected. All utensils coming in contact with such matter must be sterilized or disinfected. Linen taken from the bed should never

be placed on chairs or tables, but should be put, immediately upon removal, into a receptacle provided for it and carried in this to the disinfecting room. When caring for patients suffering from an infectious disease, a nurse should have her sleeves rolled up to, or above, her elbows, that the cuffs may not become infected, so endangering herself and others. After attending to the patient, she should immerse her hands in a disinfectant (bichlorid of mercury 1 : 1000 is frequently used) before touching anything, and then wash them with soap and hot water. This point must be remembered; nurses are constantly washing their hands and touching their faces, screens, door handles, etc., before disinfecting them.

Methods of Disinfecting Excreta.—Excreta are commonly disinfected with formalin two per cent., carbolic five per cent., slaked lime, or milk of lime. An amount of disinfectant equal in bulk to the quantity of excreta should be used and the receptacle containing the material should be covered and allowed to stand for, if it is to be emptied into the sewer, twenty minutes, or, if it is to be emptied into a privy vault, at least one hour, unless the milk of lime is used, when it must stand two hours. It is well to put a small quantity of formalin in the bedpan before giving the latter to a patient suffering with typhoid, cholera, or amebic dysentery; and in sputum cups used by tubercular patients. When possible, sputum cups which can be burned should be used. When patients are suffering from diseases in which the specific cause of the infection may be in the nasal discharges, gauze or absorbent paper handkerchiefs should be used and either burned or put into a disinfectant immediately after use.

Disinfection of Utensils.—Utensils and dishes are best disinfected by being submerged in a disinfectant. When it is impossible to disinfect such things thoroughly those used by patients that will infect them must be kept separate from those used by other people, and they must not be washed in the same pan or sink as other dishes nor dried with the same towels.

Bed Linen, etc.—Such articles are best disinfected by boiling, but can be disinfected by soaking them in a disinfectant such as formalin or carbolic. In private nursing, it is well to put sheets, towels, and the like into a boiler containing water and leave them in this until it is possible to boil them.

Isolation

When a patient is isolated, no one but the physicians and nurses should be allowed to enter the room, unless permitted by the physicians.

The Room.—When possible two rooms and an adjoining bathroom should be given up to the patient and her attendants. These should be on the top floor of the house, or if in a flat, in the most isolated portion. Other important points to consider in choosing the sick-room are the exposure to sun and daylight and facilities for ventilation. An abundant supply of sunlight is absolutely essential, and the ventilation must be continuous, and so arranged that the air from the sick-room will not pass through other rooms. To guard against this it is well, though not essential, to hang a sheet wet in a disinfectant outside the closed door. When the room is prepared for the patient, before he is taken to it, remove all

unnecessary furniture, rugs, ornaments, draperies, and clothing, and exchange all valuable articles of furniture for such as will not be destroyed by the use of the disinfectants. When the patient is already in the room nothing must be taken from it without first being disinfected. Put away all superfluous draperies and other unnecessary articles in a cupboard or drawer, and disinfect them when the room is fumigated at the termination of the disease.

The room must be dusted daily with a duster moistened in a disinfectant, and the broom used for sweeping should be covered with a duster likewise moistened. After use, these dusters should be soaked in a disinfectant and then washed. At the close of the disease the room must be fumigated; the methods of doing this will be discussed later.

The Patient.—For the patient, as far as the prevention of infection is concerned, the first consideration is absolute cleanliness. She should be bathed daily unless the doctor has ordered otherwise. Her mouth should be cleansed before and after each feeding.

The buttocks and perineum should be washed after each stool. In the eruptive diseases, when desquamation begins, the skin should be anointed daily with some oily substance to prevent its dissemination. After recovery, the patient should be given a warm bath and shampoo with bichlorid 1:5000, rolled in a sheet, which has not been in the isolated rooms, and taken to another room where she can be dressed as desired.

The Physician.—A large gown (one can be improvised with a sheet, see Chapter XXIII), a cap (one can be improvised with a small towel or table

napkin), and a pair of rubbers should be kept ready for the doctor to put on when he enters the sick-room. These should hang in the outer room if there are two rooms. If not, they should be rolled in a disinfected sheet and kept in a drawer or cupboard in the sick-room. A basin of hot water, soap, and disinfectant should be ready for the doctor to use before leaving the room.

The Nurse.—The nurse should never leave the room without washing her face and hands with bichlorid and attiring herself as the doctor does when he enters the room. Her gown, etc., should hang just outside the door of one of the isolated rooms under a sheet or curtain. She should never loiter when going through the house. While in the sick-room, she should wear a cap that will completely cover her hair. When going out of doors, she should wash her face and hands with bichlorid, and change all her clothes.

For her own protection, she should observe the following rules: She should, if possible, take a daily walk in the fresh air, disinfect and wash her hands before meals, and rinse her mouth with listerin or other disinfectant mouth wash. Unless absolutely unavoidable, she should not take her meals in the sick-room, but, when this is necessary, the tray should never be allowed to stand uncovered. When irrigating a diphtheria patient's throat, she should wear glasses to protect her eyes, and a piece of gauze tied over her mouth, for the patient frequently coughs up pieces of membrane very forcibly. Another very important point to remember, and one which when nursing it is well to observe at all times, is not to put the hands to the face and especially near the mouth

or eyes. More than one nurse has lost her eyesight by doing the latter.

At the termination of the disease, the disinfection for the nurse is practically the same as for the patient.

Fumigation of Rooms

Preparation of Room.—When preparing a room for fumigation there are two important facts to be remembered: (1) That the gaseous disinfectants do not penetrate and, therefore, will only effect a surface disinfection, so that all drawers and cupboards must be opened, shades pulled down, rugs, blankets, and the like hung over lines stretched across the room, and books opened so that each page will be exposed to the fumes. Books used by a patient suffering with measles, scarlet fever, or smallpox had better be destroyed, since it is impossible to be sure that they are perfectly disinfected. (2) That gases will escape through very small crevices. For this reason, strips of paper must be pasted around the windows, after they are closed, and over all cracks, crevices, and key-holes. The fireplace and all registers and ventilators must be closed. White paper and either a paste made of flour and water or library paste should be used for the purpose, for colored papers, newspaper, glues, and mucilage are likely to mark the woodwork. Heat and moisture are absolutely indispensable for successful disinfection with gaseous disinfectants; therefore, in cold weather the room to be disinfected must be heated beforehand, and, unless the apparatus to be used is provided with means of producing water vapor with the gas, a basin of water must be kept boiling in the room for some time before disinfection.

Method of Fumigating Rooms with Formaldehyd.—Formaldehyd and sulphur are the two gaseous disinfectants commonly used, and, for the reasons given in Chapter II, formaldehyd is considered the better germicide of the two. There are several methods of generating this gas. The generation may be carried out by a lamp or generator left within the room or it may be generated outside and the gas introduced by a tube passed within the keyhole. Other and simpler methods are using potassium permanganate and formalin or lime and formalin. To use the former pour 300 grams of small crystals of permanganate of potash in half a liter of forty per cent. formalin—these proportions are for a moderate sized room, a larger quantity must be used for a large room. Immediately upon the addition of the crystals to the formalin a violent ebullition of the latter occurs and formaldehyd is given off. When generating formaldehyd in this way it is essential to put the disinfectants into a deep pail at least twelve inches in depth, and to stand this in a large tub, otherwise everything around the receptacle holding the disinfectants will be ruined. It is well to have hot water in the tub, for this helps to keep the air moist, a very important condition when using either formaldehyd or sulphur.

The lime method consists in placing about one and one half pounds of quicklime in a wide shallow pan and pouring one half liter of formalin, forty per cent., over this. The heat generated by the slaking of the lime causes the volatilization of the formalin.

To Fumigate with Sulphur.—Use five pounds of sulphur for every 1000 cubic feet of space to be fumigated—a moderate sized room. Put the sulphur

in a pan, and this on a brick or inverted tin in a tub or pail of water. Saturate the sulphur with alcohol and light it. Burning coals can be used instead of alcohol, but are not quite as efficient.

Before starting the generation of gas, either formaldehyd or sulphur, be ready to leave the room. After doing so seal up the door by pasting paper around it. The paper for the purpose must be ready for use.

The room is left closed for twelve hours. At the end of this time the windows are opened and the room aired. When entering the room to open the windows, to avoid irritation of the throat, hold the hand over the nose and mouth.

Disinfection of Mattresses and Pillows.—These are among the most difficult objects to disinfect thoroughly and after being used by a patient suffering with either scarlet fever or smallpox, and typhoid or cholera if they have been deeply soiled with excreta, they should either be opened and their contents well exposed to the formaldehyd fumes during the fumigation of the room, or else, after a surface disinfection with formaldehyd, sent where they can be exposed to steam.

Stages in Infectious Diseases

All infectious diseases tend to run a definite course which may be divided into certain stages; viz.:

Incubation.—This is the period between the exposure of the person to the disease and the appearance of the symptoms. The patient may feel perfectly well during this time or malaise may develop and general febrile symptoms. These are spoken of

as *prodromal symptoms.* The length of the period of incubation varies in different diseases.

Invasion.—The appearance of the active symptoms of the disease is called the invasion.

The Febrile or Active Stage.—Defervescence. This is the period in which the fever declines and convalescence is established.

The Eruptive Stage.—In the exanthemata there is also an eruptive stage; *i. e.* a period during which there is a rash. This usually begins with the invasion and endures through the greater part of the febrile stage. Certain of the other diseases, especially typhoid, are also characterized by a rash, but the eruption is not as extensive.

Desquamation.—The eruption of the exanthematous diseases is followed by desquamation; *i. e.*, the shedding of epidermis in scales or sheets.

Anthrax

Anthrax is a disease contracted by man from animals. The bacillus anthracis is the cause of infection. It is now rarely seen in this country.

Incubation.—The incubation period varies from a few hours to three days.

Chicken-Pox (Varicella)

The specific cause of chicken-pox is not known. It is transmissible from the stage of invasion till the crusts have disappeared.

Incubation.—The period of incubation is ten to seventeen days, generally two weeks.

Symptoms.—The invasion is generally sudden, but,

except in the case of adults, mild. There may be vomiting, restlessness, and slight pains in the back and legs.

Eruption.—The eruption appears within the first twenty-four hours of fever; it usually begins on the trunk, back, and chest. At first, the eruption consists of red papules, later these become vesicles and are full of clear fluid. In two days the vesicles become pustules; the fluid having changed to pus. Two days later the pustules will have become dried and covered with a brown crust which soon falls off. The vesicles are usually scattered and they come out in crops so that all stages of the eruption are present at the same time. There will be no scars if scratching is prevented. The rash of chicken-pox very much resembles that of smallpox in mild attacks of the latter disease, the special points of difference being that in smallpox the rash usually appears first upon the face, there is an areola of inflamed skin around the vesicles, the latter forming, as it were, umbilications in the center of inflamed papules, and the eruption does not appear in crops so that there is only one stage present at the same time.

Temperature.—There is seldom much fever. The temperature only ranges from 100° F. to 102° F. for the first two or three days, and then falls to about normal.

Nursing.—The patient should be isolated till the crusts disappear. The body should be sponged daily and the crusts well oiled. The hands are sometimes covered with mittens, and restrained to prevent scratching.

A thorough cleansing and airing of the room at the close of the disease is all that will be needed by way of disinfection.

Cholera (Cholera Vera) (Asiatic Cholera)

Cholera occurs principally among the natives of India and China. Filth and hot weather further its propagation. It is caused by the *Spirillum choleræ asiaticæ*,[1] which enters the system through the mouth and is discharged in the intestinal evacuations. Water and clothing, which have been contaminated with the feces of the rectum, and flies, which have rested upon the same and then upon articles of food, are the most common vehicles for spreading the disease.[2]

Incubation.—The period of incubation is three to five days.

Symptoms.—The disease usually begins with headache, malaise, diarrhea, and colic. These symptoms last about two days and are followed by what is known as the *stage of collapse*, since the excessive vomiting and purging that occur soon produce all the symptoms of collapse. Though the temperature is high, the skin is cold and clammy, also it is shrunken and livid; rapid emaciation occurs; there is intense thirst; severe muscular cramps; a diminished secretion of urine; and the stools soon assume the characteristic appearance which has caused them to be named *rice water stools*. This appearance occurs because, on account of the constant purging, all fecal matter is washed from the intestines and the stools consist of water and salts derived from the blood and small whitish particles of epithelium that have been washed from the intestinal walls. The patient often dies

[1] Discovered by Koch in 1884.

[2] In times of epidemic all water used for drinking should be boiled and only cooked foods eaten.

during this stage from heart failure. If not, the reactionary stage begins, the surface of the body becomes warmer, and recovery slowly ensues.

Nursing.—Rigid isolation must be maintained. To lessen the danger of heart failure the patient must be kept absolutely quiet. The maintenance of continual external heat, to lessen the danger of collapse, is essential.

Hypodermoclysis of hot saline solution is now commonly given to counteract the effect of the constant purging upon the system.

Diphtheria

Etiology.—Diphtheria is an acute contagious disease characterized by the production of a grayish-white membrane, and by more or less toxemia due to the toxic substances produced by the bacteria and absorbed by the blood. The germs, however, remain in the membrane, only in very severe attacks are they found in the blood. It is caused by the Klebs–Löffler bacillus.[1]

Infection.—The posterior pharyngeal walls, the larynx, and the trachea are the most frequent seats of the disease. The infection is given off in the discharge from the nose and mouth and in pieces of membrane.

When proper care is taken to prevent all discharges containing the germs from drying and being blown about, only the immediate surroundings of the patient will be infected. For this reason, patients suffering from diphtheria may be more easily isolated at home than those afflicted with smallpox, scarlet fever, and

[1] So called because discovered by Klebs and Löffler (1893).

measles. The germ is, however, long-lived, and a severe epidemic may result from lack of disinfection or improper disinfection.

INCUBATION.—The period of incubation is one to ten days.

SYMPTOMS.—General malaise, sore throat,[1] and the glands in the neck swell.

TEMPERATURE.—The temperature is irregular, but it seldom rises above 103° F. It lasts a week or ten days in ordinary cases and goes by lysis.

PULSE.—The pulse is frequent, and, in a case of any severity, will be weak and irregular. A pulse below 60, or one above 120, indicates cardiac weakness.

THE THROAT.—The throat is first red and slightly swollen. By the end of the first day, a pale gray membrane[2] forms and spreads rapidly, becoming thicker and more opaque. If stripped off, it leaves a bleeding surface and will form again. On recovery, the membrane curls at the edges and comes off in flakes.

In laryngeal cases, the membrane is not always seen, and, apart from the general malaise, the dreaded diphtheritic croup may be the first intimation of its presence. Such cases are always more serious than pharyngeal diphtheria. So sometimes is the nasal form. In the latter, the child will have snuffles, mouth-breathing, sneezing, and a thin, putrid dis-

[1] A sore throat with low temperature should always be regarded with suspicion, especially if the temperature remains low after a membrane forms.

[2] This membrane is supposed to be the result of the coagulation of the inflammatory exudate (which has transuded from the capillary walls) by a ferment derived from the disintegrated leucocytes.

charge from the nose, containing the Klebs–Löffler bacillus.

The most common causes of death in diphtheria are toxemia, asphyxia, and sudden heart failure.

Dyspnea, which is often severe, in diphtheria, is not only the result of obstruction in the breathing, but also of the toxemia.

COMPLICATIONS.—The most frequent complications are: heart failure, acute nephritis, broncho-pneumonia, and paralysis, particularly of the recti muscles of the eye, the muscles of the tongue, and those of deglutition. Regurgitation of the food is the premonitory symptom of the last, and, whenever this happens, it should be reported to the doctor.

NURSING.—Isolation of the patient should extend from the first throat symptoms till two cultures show absence of the Klebs–Löffler bacilli.[1] Particular attention must be paid to the pulse, because heart failure is a very common complication. Spraying and irrigation of the throat must be faithfully performed, as much depends upon it. When spraying the throat, the nurse should wear glasses to protect her eyes, and tie gauze loosely over her mouth and nose. An abundance of water must be given and liquid diet. It is often difficult to make the patient take sufficient nourishment, but this should be insisted upon, it being very necessary to keep the patient well nourished in order that the system may be better able to combat the toxic effects of the disease. If the throat becomes

[1] An exception is made to this rule in cases in which the bacilli persist longer than one month after the disappearance of the membrane. It has been demonstrated that, after that length of time, the germ is not more noxious than that found in the throats of those in health.

so filled with membrane that there is a danger of asphyxia the doctor inserts an intubation tube, but since the advent of antitoxin the need for intubation has decreased enormously. Antitoxin is now given as soon as the diagnosis is made, and is sometimes repeated in twelve or twenty-four hours. It is also given to all those who have been exposed to the disease.

When feeding patients who have been intubated it is often necessary to place them with the head lower than the body.

When nursing a person suffering with diphtheria all cuts or abrasions in the skin must be protected, for one of the most serious forms of cellulitis is likely to follow infection by the Klebs–Löffler bacilli.

Pseudo-Diphtheria

Pseudo-diphtheria often complicates such diseases as scarlet fever and measles. The lesion is much the same in appearance as in the true diphtheria, but it is less adherent and is more often limited to one tonsil. Furthermore, the temperature is higher and the toxemia less than in diphtheria.

This disease is caused by streptococci or by bacilli very closely resembling the Klebs–Löffler bacilli, but not by Klebs–Löffler bacilli.

Dengue (Break-Bone Fever)

The specific cause of dengue is unknown. It occurs chiefly in southern and tropical climates.

Incubation.—The period of incubation is one to four days.

Symptoms.—The symptoms of dengue in its initial stage are: Sudden rise of temperature, 101°–103° F.; intense pain in the bones, muscles, head, and eyes; a slight rash, variable in character, which is often associated with an intense itching. The temperature falls about the third day and the other symptoms abate, but stiffness of the muscles and joints may continue for some time.

Bacillary Dysentery

Bacillary dysentery is a highly infectious disease of the intestines, of which Shiga's bacillus is the active cause. One form of the disease is the so-called *summer diarrhea of children.*

The disease occurs almost everywhere, but, especially in adults, it is more common in tropical countries. Dysentery is thought to be a water-borne disease. Hot weather, unsanitary surroundings, and unsuitable food are predisposing causes.

Symptoms.—The passage of frequent small stools containing blood, mucus, and pus, but little fecal matter, pain and tenderness over the colon, tenesmus, and, if the infection is severe, a high temperature and great prostration. The toxemia is excessive in severe cases and death may occur in a few days. When the patient recovers, convalescence is usually established in two or three weeks, but in some instances though the severity of the symptoms abates, the diarrhea and tenesmus may continue for months and extreme emaciation, anemia, and other complications result.

Nursing.—Fresh air, quiet, and cleanliness are important. The same disinfection should be carried

out as for typhoid. In the case of infants, it is well to use paper napkins which can be burned. If diapers that must be washed are used they should be put into water or a disinfectant immediately upon removal and boiled. It is very essential to note the character of the stools. Rectal irrigations are usually ordered. They must be given very slowly, or extreme pain will be caused, and the water should be about 100° F. If, as is often the case, nitrate of silver is to be added to the water, the latter must be distilled, for the silver unites with sodium chlorid, which is nearly always present in undistilled water, and forms an insoluble silver chlorid. During the acute stage, the patient is usually kept on a Pasteurized milk diet, unless curds appear in the stools. Later, gruels form a large part of the diet.

Erysipelas

Erysipelas is caused by the streptococcus erysipelatis. It enters the body through abrasions or wounds in the skin or mucous membrane.

Incubation.—The period of incubation varies from three to fourteen days.

Symptoms.—In severe cases there is generally a chill, followed by a rise of temperature from 103°–104° F., and the usual constitutional symptoms associated with fever. The tissues of the affected part became red and swollen, and there is a strong line of demarcation around the edge of the inflamed area.

In facial erysipelas, the inflammation usually begins on the bridge of the nose or around the mouth. It may spread over large areas of the body. When this occurs, the disease is known as migratory erysipelas.

Such cases may be protracted for weeks. In ordinary cases, convalescence occurs at the end of one or two weeks.

Complications.—Complications are rare; but abscesses, malignant endocarditis, pneumonia, nephritis, and, in cases where the larynx is involved, edema of the glottis sometimes occur.

Nursing.—The danger of infection is limited to wounds, so that absolute isolation, except in a surgical or obstetrical ward, is unnecessary; but all discharge and soiled dressings should be disinfected or burnt immediately. The nursing is the same as in all cases of fever.

Gonorrhea

Gonorrhea is an acute, infectious, and virulent process which attacks most frequently the mucous membrane of the urethra and the structures in anatomical relation with it, though other parts of the body, especially the eye,[1] may be the seat of infection.

Gonorrheal Arthritis

Gonorrheal arthritis is due to the presence of gonococci in the joints.

Symptoms.—The symptoms are in some respects similar to those of rheumatism; but the fever and constitutional symptoms are slight, and the swelling in the joints is seldom present in the beginning of the attack. Urethral discharge should be watched for in such cases, and nurses should be careful to disinfect their hands thoroughly after caring for the patient.

[1] See under Diseases of the Eyes.

Gonorrheal Vaginitis

The vaginal mucous membrane is reddened and covered with papillæ. There is a profuse discharge, which is serous at first, but soon becomes a thick, purulent pus. The condition is highly contagious and has been known to spread rapidly through an entire hospital ward. Children are particularly susceptible.[1] Too much stress cannot be laid upon the importance of the immediate isolation of the patient, and of the careful disinfection of the articles coming in contact with her, and of the hands, after touching her or such articles.

Hydrophobia (Rabies)

The specific germ of hydrophobia has not yet been isolated; but the toxin which it develops is obtained from the central nervous system and the secretions of animals suffering from the disease. Man most frequently contracts the disease by inoculation with the saliva of such animals when bitten by them.

Incubation.—The period of incubation averages six weeks, but may be longer—five or six months.

Symptoms.—The onset is gradual and is characterized by pain and congestion in the cicatrix, together with great mental depression, irritability, and hyperesthesia of the special senses. This is followed by the spasmodic stage, in which the nervous symptoms are all increased and convulsions may be induced by attempting to swallow, by noise, or even by draughts of air. The pain in the laryngeal muscles is severe,

[1] Nurses are always held responsible for the spread of this disease in a hospital ward. They should therefore be keen in recognizing and reporting the presence of any vaginal discharge.

dyspnea is at times intense, the respiration is spasmodic, and there is foaming at the mouth, due to the excess secretion of saliva caused by the constant spasm of the jaws. The temperature varies, being subnormal in some cases, while in others there is a moderate fever of 100° to 102° F. This stage is followed by one of paralysis, which is marked by the cessation of spasms, and a paralysis of the muscles and nerves of sensation.

Prognosis.—Only about 15 per cent. of those bitten by mad dogs develop the disease. When it does develop recovery is rare. Bites on exposed surfaces such as the face and hands are the most dangerous. When they are on other parts of the body, the clothing absorbs a certain amount of the saliva and thus lessens the infection.

Treatment.—If possible the patient should be taken at once to an institute where he can be given the specific antitoxin. It will take at least two weeks for the virus injected by the dog to develop and if, in the meantime, the patient's blood is provided with antitoxin the latter will usually render the toxins harmless as they are formed. If this treatment cannot be procured the wound should be cauterized at once with crude carbolic, caustic soda, or a hot iron, a cupping glass applied to encourage bleeding, and the wound kept open. If the bite is on a limb a tight bandage should be applied above the wound until the latter is cauterized. It must not be left on longer than 45 minutes.

Influenza

Influenza is an acute, infectious disease, due to the bacillus of Pfeiffer.

Incubation.—The period of incubation is from two to four days.

Symptoms.—The symptoms vary considerably in different cases. The onset is generally sudden. There may be a slight chill followed by rise of temperature. There are an intense aching of the muscles, especially those of the legs and lumbar region, coryza and catarrh of the throat and bronchi, the discharges from which will contain the infection. Nervous symptoms, such as headache, prostration, and neuritis, predominate in some cases, while others are characterized by severe abdominal and gastro-intestinal phenomena.

Temperature.—The temperature varies considerably, according to the severity of the case. In mild cases, it remits between 100° and 102° F., while in severe cases it will remain persistently between 103° and 104° F. It falls by lysis. Recovery from mild uncomplicated attacks of the disease may take place in two or three weeks, but a feeling of lassitude and depression may persist for some time and complications and sequelæ are common.

Complications.—Otitis media, bronchitis, and pneumonia are the most common complications.

Nursing.—The disinfection necessary for all infectious diseases should be carried out. The general care is the same as in all fever cases.

Leprosy

Leprosy is a chronic infectious disease caused by the bacillus lepræ. Infection is transmitted by direct contact and by fomites, the germ entering the body through abrasions in the skin or mucous membrane.

There are two types of the disease: (1) tubercular leprosy, characterized by the formation of tubercular nodules in the skin and mucous membrane, followed by ulceration, which sometimes erodes so deeply that the loss of fingers and toes results. (2) Anesthetic leprosy, in which, owing to the invasion of the nerve trunks by the bacilli, portions of the skin become anesthetic and the muscles of the extremities contract and atrophy.

Nursing.—There need be no fear of infection if all abraded surfaces on the hands are protected and the hands are carefully disinfected after doing anything for the patient or touching anything that has come in contact with him. The patient must be kept well nourished, clean, and as much as possible in the open air. The ulcers should be treated as wounds.

Malta Fever (Mediterranean Fever) (Neapolitan Fever)

Malta fever is an acute endemic disease caused by the micrococcus melitensis. It is found chiefly in cities bordering the shores of the Mediterranean, but also, to some extent, in other hot countries.

Incubation.—The period of incubation varies from a few days to a fortnight.

Symptoms.—In the beginning, the disease resembles typhoid, but the fever is remittent. After two or three weeks the temperature reaches normal, remains so for two or three days, and is then followed by a relapse, which is often more severe than the primary invasion. It is marked by frequent chills, a high but intermittent temperature and sometimes delirium, diarrhea, excessive weakness, and a tendency to collapse. This stage may endure for five or six weeks.

Recovery may then take place, or, after a few weeks or even months of convalescence, another relapse may occur.

Nursing.—The treatment and general care of the patient is the same as in typhoid fever.

Measles (Rubeola)

Measles is undoubtedly the result of a germ infection, but the specific organism has not yet been isolated. It is highly communicable, but the infection is usually less severe and shorter-lived than that of scarlet fever.

Measles is communicable from the onset until desquamation ceases. The infection is spread by the desquamating skin and all the secretions, especially those of the nose and mouth.

Incubation.—The period of incubation is ten to fourteen days.

Symptoms.—A child during the incubation of measles will probably be fretful and feverish. The invasion is characterized by a gradually rising temperature, coryza, sneezing, cough, and a thin nasal discharge. Nausea and vomiting are also common.

Eruption.—The eruption appears on the fourth day. It can often be first seen on the mucous membrane of the mouth. Later it appears successively upon the chin, forehead, sides of the throat, face, and body. It consists of red elevated spots that tend to coalesce into crescent-shaped blotches but which do not become confluent as in scarlet fever. The rash persists for from two to five days and then fades, in the order of its appearance, and is followed by a fine, mealy desquamation that will continue for a week or more.

With the appearance of the rash the patient will probably become quite ill, the tongue will be heavily coated, the tonsils swollen, and the coryza worse. These symptoms abate as the rash fades, and when no complications ensue convalescence is generally rapid.

THE TEMPERATURE.—The temperature rises to 102°–104° F. on the first day. It remits one or two degrees during the next two days. It rises again when the rash appears, and remains up till the rash fades, when it falls, sometimes by crisis, at other times by lysis.

COMPLICATIONS.—The more common complications are broncho-pneumonia, laryngitis, otitis media, chronic conjunctivitis, fatal epistaxis, purpura.

NURSING.—The general nursing is the same as in all other fevers. Isolation should be continued from the first symptoms until desquamation ceases. Measles is particularly infectious during the incubation period. The eyes require special attention. They must be shaded from the light and cleansed as often as necessary (boric acid 2% is always safe to use if the doctor gives no special prescription). The patient should not be allowed to read, even during convalescence. The nose, mouth, and throat also must be constantly cleansed, otitis media being generally the result of improper care of the same. The room must be kept well ventilated and at a uniform temperature, 68° F. All draughts are to be guarded against, especially during convalescence. A sudden chilling of the skin is very likely to cause pneumonia or nephritis.

German Measles (Rubella)

The specific cause of German measles is unknown.

Though it resembles measles in many points, it bears pathologically no relation to it.

INCUBATION.—The period of incubation is ten to fourteen days.

SYMPTOMS.—German measles is marked by enlargement of the cervical lymphatic glands, and, in some cases, of those of the axilla and groins also. The other symptoms resemble those of measles, but are milder.

ERUPTION.—There are two types of eruption, one being somewhat like that of scarlet fever, and the other like that of measles, except that it never takes a crescent form. The rash appears about the second day, first behind the ears and around the mouth, whence it spreads to the chest and over the body. It lasts two or three days and may be followed by a slight desquamation.

TEMPERATURE.—Unless there is more than the ordinary degree of inflammation of the lymphatics, the temperature seldom rises above 100° or 101° F., and it rarely persists longer than one or two days.

NURSING.—The patient should be kept quiet—not necessarily in bed—in a uniformly heated room. Isolation should be continued till desquamation ceases, which is usually after ten to fourteen days. A thorough airing of the room and disinfection of utensils and clothing are all that is necessary in the way of disinfection at the end of the case.

Meningitis. Cerebrospinal Meningitis (Spotted Fever)

This is an infectious disease caused by the meningococcus or diplococcus intracellularis. It is characterized by an inflammation of the cerebral and spinal meninges.

PREDISPOSING CAUSES.—The predisposing causes of meningitis are: other diseases, such as diphtheria, influenza, measles, and pneumonia, general debility, exposure to wet and cold.

INCUBATION.—The period of incubation is uncertain.

SYMPTOMS.—The onset is generally sudden, beginning with a chill or convulsion, and followed by a rise of temperature, intense headache, projectile vomiting, photophobia, and strabismus. There is often delirium even in the early stages of the disease. The patient may be exceedingly restless, emitting from time to time a sharp typical cry. The muscles of the neck become rigid, causing a retraction of the head. The patient often lies with the thighs flexed, so that they form a right angle with the trunk, and the legs cannot be extended. This is known as *Kernig's sign.* There is generally hyperesthesia of the skin and muscles. Convulsions may occur at any time during the disease. Petechiæ and herpes are common, and at times there is general purpura.[1] Diagnosis is confirmed by finding the specific germ in the cerebrospinal fluid, which is obtained by lumbar puncture.

THE TEMPERATURE.—The temperature varies greatly in different types of the disease. Its course is very irregular. In mild cases there will be little rise of temperature, and the other symptoms will be correspondingly slight. Recovery generally takes place in a few days. In abortive cases, the initial symptoms are similar to severe cases, but they cease suddenly after a few days. In intermittent cases the temperature periodically falls and other symptoms

[1] The name of spotted fever was formerly given to meningitis on account of the purpura often associated with it.

abate, but the improvement only lasts a few hours or days. Chronic cases sometimes drag on for months, with frequent exacerbations and remissions. The patient may be continually restless or may lie in a state of semi-coma. Such cases are generally fatal. Malignant cases end fatally in from twelve hours to three days, death being due to toxemia.

COMPLICATIONS AND SEQUELÆ.—The possible complications are pneumonia, pleurisy, endocarditis, pericarditis, otitis media, inflammation of the auditory nerve followed by deafness, inflammation of the optic nerve and consequent blindness, paralysis of some part of the body, and mental feebleness. In children, growth may be stunted, and chronic hydrocephalus may appear even some weeks after convalescence.

OTHER FORMS OF MENINGITIS.—The most common ones are: purulent meningitis, in which the inflammation is generally due to infection from otitis media, mastoiditis, etc.; and tubercular meningitis, in which it is due to the tubercle bacilli.

NURSING.—The patient should be kept quiet in a cool, 65° F., dark room. All discharges from the throat and mouth should be disinfected, and gauze, which must be burnt after use, should take the place of handkerchiefs. Feeding, which frequently must be done by nasal gavage, is of the utmost importance.

Mumps (Infectious Parotitis)

The specific cause of mumps is unknown. It is communicable from the onset until after the swelling entirely disappears and sometimes even longer.

INCUBATION.—The period of incubation is two to three weeks.

Symptoms.—The symptoms are headache, nausea, pain, which is increased by eating anything sour, and swelling of the parotid glands, just below and in front of the ear.

Temperature.—In mild cases the temperature varies between 100° and 102° F.; in severe cases it may go as high as 105° F.

When no complications ensue recovery is generally complete in a week or ten days.

Complications.—Earache, otitis media. The generative organs are sometimes affected. Meningitis has occurred and also suppuration of the parotid gland, but the last three complications are rare.

Nursing.—The patient should be isolated and kept in bed until the temperature is normal and the swelling has entirely disappeared. The frequent cleansing of the mouth is of the utmost importance, as the majority of cases in which otitis media develops may be traced to neglect in this matter.

Plague

The specific cause of the plague is the bacillus pestis. It occurs in the buboes, urine, feces, and blood. It is frequently found in the soil, in countries where the disease is prevalent. The disease attacks the lower animals, especially rats, and they, flies, and fleas are often the means of spreading it. It can be contracted through the respiratory and alimentary tract, but inoculation is the most common method of infection.

Predisposing Causes.—The predisposing causes are diet, crowding, and lack of proper nourishment.

Incubation.—The period of incubation is three to seven days.

Varieties.—There are three varieties of the disease: the bubonic, the pneumonic, and the septicemic.

The Bubonic.—The bubonic type is the most common; it is so called because of the characteristic enlargement of the glands, to which the name buboes has been given.

Symptoms.—The onset is abrupt. There is a chill, followed by a fever of 102°–106° F., and leucocytosis. The prostration is marked. The buboes appear from the second to the fifth day. The axillary, femoral, and inguinal nodes are the ones usually attacked. These buboes may soften and resolve, they may suppurate and break through the skin, or they may become gangrenous. Hemorrhages under the skin are common and look like small black spots. Formerly, these marks were called the *plague spots* and the disease the *black death.*

The Temperature.—The fever remits soon after the appearance of the buboes, but it quickly rises again, remains high for about a week, and finally falls by lysis.

Prognosis.—The mortality is about 50 per cent.

The Pneumonic Type.—In the pneumonic type there is a broncho-pneumonia and the bacillus pestis is found in the sputum.

Prognosis.—The mortality is 95 per cent.

Septicemic Type.—In the septicemic type, the patient is so poisoned by the infection that death occurs before the buboes appear.

Nursing.—The buboes, unless they suppurate, are generally incised. The after-treatment is then the same as for any suppurating wound. Rigid isolation, cleanliness, and fresh air are of primary importance. The febrile symptoms are treated as in any other case of fever. The tendency to sudden collapse must be

remembered, and treatment for it started at the first symptoms.

Pneumonia

NATURE.—Pneumonia is an acute inflammatory condition of the lungs.

CAUSE.—The *micrococcus lanceolatus*, also known as the *pneumococcus*, is the cause of what is known as *true lobar pneumonia*, but inflammation of the lungs —pneumonia—may be caused by a variety of germs.

MICROCOCCUS LANCEOLATUS.—This micro-organism is constantly found in the mouth of even perfectly healthy individuals and it is now thought to be the cause of many other serious conditions besides lobar pneumonia, *e. g.* lobular pneumonia, pleurisy, pericarditis, endocarditis, peritonitis, and septicemia.

PREDISPOSING CAUSES OF PNEUMONIA. — The pneumococcus is almost constantly present in the mouth awaiting suitable conditions to become active and these it finds, first, when the body is debilitated by disease, malnutrition, and old age. Thus pneumonia frequently complicates other diseases and is a very common cause of death of badly nourished infants and the aged. When pneumonia complicates other diseases and causes the death of the patient it is spoken of as *terminal pneumonia*. The second set of predisposing causes are, anything that will cause irritation of the lungs: *e. g.* accidents to the chest—traumatic pneumonia; embolism in the lung—embolic pneumonia; the inhalation of gas, including anesthetics, or the inspiration of fluid or vomitus into the lung-inhalation pneumonia; congestion in the lungs due to chilling of the body. The third predisposing cause is poor circulation of the blood in the lung—hypostatic

pneumonia. This form of pneumonia is very likely to occur when old people or those suffering from heart disease are allowed to lie too long in one position.

Condition of the Lungs in Pneumonia.—The lung presents four different conditions that are spoken of as *stages* during an attack of pneumonia. In the first stage—called the *stage of engorgement*—there is severe congestion of the blood in the capillaries of the affected part of the lung. As this condition increases, serum, red corpuscles, and fibrin ooze from the capillaries into the air cells so that this portion of the lung loses its spongy character and becomes of such a solid consistency that it somewhat resembles liver in texture and is of a deep red color. This condition is known as *red hepatization*—from the Greek *hepar*—the liver. The phagocytes soon collect in such great numbers in the inflamed area that it assumes a grayish color and the time during which the lung is in this condition is spoken of as the *stage of gray hepatization*. This is followed by what is known as the *stage of resolution*, in which a large number of the white corpuscles become broken down in their fight with the bacteria, thus setting free a ferment they contain, which causes the liquefaction of the solid substance in the air cells. The resulting liquid is absorbed by the blood and carried away.

Lobar Pneumonia

Lobar pneumonia is so called because at least one whole lobe of a lung is involved in the inflammatory process. When, as sometimes occurs, a lobe or lobes in both lungs become consolidated the condition is known as *double lobar pneumonia*. Sometimes as

one lobe resolves another becomes consolidated; this is spoken of as *migratory pneumonia.*

The amount of lung consolidated is not of as much importance in determining the outcome of the disease as the degree of toxemia produced by the bacterial poisons and the facility with which antitoxin substances that will overcome the toxins are produced. The toxemia in severe infections by the pneumococcus is excessive and its effect on the heart is so bad that heart failure often results.

Symptoms.—The disease generally comes on suddenly with a severe chill, followed by a rise of temperature to 104°–105° F., increased respiration, and a cough accompanied by pain. The face is flushed, particularly the cheeks, the nostrils dilate with each inspiration, and herpes is generally present, especially around the lips.

Sputum.—The state of the sputum is of great diagnostic value in pneumonia. During the first stage it is a frothy serous fluid mixed with mucus. But in the second stage it becomes extremely tenacious and streaked with blood. Sometimes it assumes a reddish-brown color—a prune-juice sputum. This is always a grave indication. When resolution begins, the expectoration gradually ceases to be blood-streaked, and becomes, at first more abundant, and then gradually less in quantity.

Temperature.—The temperature rises immediately after the initial chill to about 104° or 105° F., and remains there, with but slight remission, till resolution takes place. This happens, as a rule, either on the third, fifth, seventh, or ninth day. In the majority of cases it then falls by crisis, but occasionally it falls by lysis, taking three or four days to reach the

normal line. If it remains continuously high for a much longer period, it may be due to complications or to delayed resolution.

Pulse.—In pneumonia the pulse is full and bounding, ranging from 96 to 120 or 140. There is perhaps no disease in which it is more important to note the pulse carefully, since death occurs in a large number of instances from heart failure.

Respiration.—The respirations are shallow and rapid, and there is always more or less dyspnea. Increasing respiration and cyanosis are of serious import.

Leucocytosis.—The leucocytosis is high—25,000 to 35,000.

Complications.—The most common complications of pneumonia are tympanites, pleurisy, endocarditis, pericarditis, edema of the lung, and, in alcoholic patients, delirium tremens.

Sequelæ.—The most frequent sequelæ are empyema, abscess of the lung, and gangrene of the lung.

Broncho-pneumonia

This form of pneumonia is so called because it is usually secondary to an acute bronchitis. It is known also as lobular pneumonia because the entire lobe of a lung is not involved, as in lobar pneumonia, but separate groups of alveoli in a lobe or lobes. The exciting cause may be the pneumococcus, but, quite as frequently, it is some other form of bacteria.

This is a very common disease in childhood and old age.

Temperature.—The temperature is continuously high but has wide daily fluctuations. It frequently falls by lysis.

PULSE.—The pulse is usually very rapid, 150 per minute and over.

COUGH AND EXPECTORATION.—The cough is usually persistent and troublesome. In the case of a child it can sometimes be relieved by turning the child over on its face so that the mucus may be dislodged and run out of its mouth. A child seldom expectorates before it is three years old.

SEQUELÆ.—Complications, such as abscess of the lung and gangrene, are likely to follow.

NURSING.—There are few diseases in which careful nursing is of more importance than pneumonia. In the first place, it is necessary that every effort be made to limit the patient's movements in order to conserve his strength and to give the heart as little work as possible. Therefore when moving and turning him he must not be allowed to assist; his wants must be anticipated, as for instance he must not be allowed to reach for his glass of water nor to hold it while drinking, nor after coughing to wipe the mucus from his lips. He should not be allowed to talk much, nor should visitors see him without the doctor's permission. Symptoms of delirium must be watched for and to avoid the condition care must be taken not to allow him to become excited. As restraint of any kind is apt to cause great excitement it must be avoided as long as possible, and when necessary it must be applied without restricting the movements of the chest.

Tympanites is a frequent complication of pneumonia and is a serious condition, as it interferes with the heart action; any appearance of it should be reported. Hot fomentations to the abdomen and the insertion of the rectal tube are often ordered to

relieve the condition. When inserting the rectal tube always put its free end in a bedpan or kidney basin, as fecal matter is likely to be discharged with the gas.

Edema of the lungs is another common and exceedingly dangerous complication which needs instant treatment. Its presence is recognized by the hard moist sounds in the breathing and increasing cyanosis. Any suspicion of it should be reported, and the cupping glasses, or whatever form of treatment the doctor in charge of the case usually uses, prepared for instant use.

Heart failure is another emergency to be on the watch for. In "private nursing," a nurse should have an understanding with the doctor what stimulants he wishes her to give in such an emergency. In a hospital, she should bring stimulants likely to be needed to the bedside together with the disinfected hypodermic syringe, while awaiting the doctor's arrival. Heart failure is frequently caused by the patient sitting up in bed or exerting himself in other ways.

The fresh-air treatment is now much used in treating pneumonia; this is described on page 721. When the weather makes it necessary to wrap the patient up as there described, care must be taken not to restrict his breathing; this can be prevented by putting a *low* bed-cradle over his chest.

The sudden drop in the temperature, which usually marks the crisis of pneumonia, is sometimes attended with alarming results, to prevent which the patient must be covered with a blanket and a hot-water bag placed at his feet as soon as the temperature begins to fall.

In caring for a patient with pneumonia, it must be remembered that, especially when caused by the pneumococcus, it is an infectious disease, and as the germ is contained in the sputum, this must accordingly be properly disposed of. Paper or gauze handkerchiefs should be used and treated as described in the section on disinfection at the beginning of this chapter. As the doctor wishes to see a specimen of sputum daily, some of it must be received into sputum cups. These, unless they are such as can be burned, must be most carefully disinfected after use, preferably by boiling. When a patient is delirious, it is often impossible to prevent his expectorating on surrounding objects. To prevent things becoming so soiled, a piece of gauze can be attached to the head and sides of the bed at some distance above the patient's head.

Poliomyelitis (Acute Anterior)

This disease, known also as *infantile paralysis*, occurs most frequently in children under three years of age, very rarely after puberty. It is, as the name implies, an inflammation of the anterior or front part of the gray matter of the spinal cord. Though no causative micro-organism has been discovered, the disease has so frequently occurred in epidemics that it is now generally thought to be due to germ infection. The onset of the disease is usually sudden, beginning either with acute fever or convulsions followed by paralysis in one or more of the extremities. The primary symptoms subside in a few days and with proper treatment the paralysis decreases, but there is seldom a complete recovery.

Massage and exercise of the limb by electricity are the special points of the treatment and every means must be taken to keep the child well nourished and in good health.

Scarlet Fever (Scarlatina)

The exciting cause of scarlet fever is unknown. Some authorities consider it a streptococcus infection, because complications due to these organisms so frequently complicate the disease, but others think that a protozoön that has been isolated from desquamated scales of skin is the cause. The infection seems to be contained in the desquamating skin and in all the secretions, especially those of the nose and throat, and it is very difficult to destroy.

Incubation.—The period of incubation varies from one to ten days.

Symptoms.—The onset is sudden. Young children often have convulsions; older children and adults, a chill. In other cases, the secondary symptoms, viz., vomiting, sore throat, headache, and abrupt fever, 103° to 105° F., come on immediately.

Eruption.—The eruption, which appears within eighteen to thirty-six hours, comes out first on the neck, chest, and back, and then spreads rapidly over the entire body and the upper part of the face. The rash in scarlet fever rarely involves the chin and the outside of the mouth. It is, however, very apt to be found in quite thick patches in the pharynx. The eruption consists first of pale red points; when the finger nail is drawn through these it leaves a white line that remains for a minute or two and then disappears. In a few hours the rash becomes confluent,

producing a uniformly red surface which continues for four or five days. At the end of this time it fades, and is followed a few days later by desquamation, which continues from one to seven weeks.

TONGUE.—The condition of the tongue is of diagnostic value in scarlet fever. It is at first white and coated, but in a day or two it becomes intensely red and the papilla much swollen, producing what is called the "strawberry tongue."

THROAT.—The throat is inflamed and sometimes ulcerated. A false membrane may cover the tonsils, as in diphtheria, but, unless the patient has diphtheria also, the Klebs-Löffler bacilli will not be present.

TEMPERATURE.—The temperature rises on the first day to about 104° or 105°. It remains high for three or four days and falls by lysis.

COMPLICATIONS.—The more common complications are edema of the glottis, suppuration of the lymph nodes in the neck, adenitis, cellulitis of the neck, purulent otitis media, acute endocarditis, nephritis, and arthritis.

SEQUELÆ.—The more common sequelæ are chronic endocarditis, chronic nephritis, deafness, paralysis, and blindness.

PROGNOSIS.—Healthy children, when well cared for, generally recover, but sequelæ may follow.

IMMUNITY.—One attack generally renders a person immune.

NATURE OF DESQUAMATION.—The desquamation in scarlet fever differs from that of any other disease, in that the superficial skin can be peeled in long strips.

NURSING.—The general treatment is the same as in all febrile diseases. The room should be kept well

ventilated, but free from draughts, and at a uniform temperature, 68° F. The urine should always be measured, and any change in its amount or appearance reported immediately to the physician. The care of the mouth and throat is of the utmost importance. After desquamation begins, the body should be rubbed with oil or ointment daily, so as to prevent the scattering about of particles of skin and with them the infection. Strict quarantine should be observed from the moment that there is any suspicion of the disease. It should be maintained for at least two months. When quarantine is over, all toys and books used by the patient and anything that has been in the sick-room which cannot be perfectly disinfected should be destroyed.

Septic Diseases

Septicemia.—Septicemia is a disease caused by certain species of bacteria, which enter the body through wounds or abrasions in the skin or mucous membranes. They cause suppuration of the tissue and the formation of toxins, which, being absorbed by the blood or lymph, poison the system. The uterus after labor or abortion is a frequent site of infection. Sepsis may also follow suppurative diseases of any of the organs of the body. The micro-organisms most commonly associated with this condition are the streptococcus and staphylococcus of suppuration, and, sometimes, the pneumococcus, meningococcus, gonococcus, etc.

Symptoms.—Twelve hours to two or three days after the infection there is a chill, the temperature rising during the chill to 104° or 105° F. There will be nausea, headache, anorexia, and all other febrile

symptoms. Leucocytosis is pronounced. In mild cases, under proper treatment, the symptoms may subside after a few days. In severe cases, the patient quickly passes into a typhoidal condition. The mind may remain clear or there may be delirium. The temperature remains persistently high, the surface of the skin is often cold and covered with perspiration, cyanosis is often marked, and the face is pinched and drawn. The discharge from the wound if such exist is diminished, but the tissues are brown and dry, and there is a foul, fetid odor. In cases of puerperal sepsis, the lochia becomes exceedingly foul. In sepsis following a suppurative disease of any organ the symptoms are much the same, but usually come on more slowly, the temperature is irregular, and there is a continual series of chills, fever, and sweating. Various eruptions, such as erythema and petechiæ, often appear.

Nursing.—The treatment is the same as in all surgical and febrile cases. When the patient recovers, convalescence is liable to be long and tedious. Fresh air and nourishing food are then two of the most essential things to be considered in the nursing.

PYEMIA.—Pyemia is caused by the same organisms as septicemia, but, owing to the entrance of the bacteria into the veins, thrombi form and embolism results. The emboli, being septic, break down and form abscess cavities wherever they lodge.

The formation of an abscess is generally marked by a chill. This may occur daily, or even more frequently. The temperature falls before the chill and rises during it, mounting, sometimes, even as high as 107° F. The other symptoms are those of septicemia in a marked degree.

The prognosis is very bad, death usually resulting within a few days.

Smallpox (Variola)

The specific germ of smallpox is supposed to be a protozoan. It is an extremely virulent and highly communicable disease, characterized by a high fever and typical eruption.

Incubation.—The period of incubation is one to three weeks, usually twelve days.

Symptoms.—The symptoms are a sudden intense fever, 103°–105° F., that may or may not be preceded by a chill, or in children by a convulsion; severe headache; intense pain in the lumbar region and extremities; vomiting; and, often, delirium.

Eruption.—The eruption proper appears on the third day, but it is often preceded by an initial roseola that resembles the rash of scarlet fever.

The typical eruption has five stages—the macule, the vesicle, the pustule, the crust, and the cicatrix. Each of the first two stages continues for three days. 1. A small, hard lump is felt under the skin. 2. A vesicle forms above the skin. 3. The serous fluid of the vesicle turns to pus. The duration of this third stage depends upon the severity of the disease. It is followed by the formation over the surface of each vesicle of a crust, the nature of which also depends upon the severity of the disease. In mild cases they are little more than scales of skin, while in others they are of a thick crusty character and leave a deep pitting when they drop off, as they generally do by the end of the third or fourth week. Owing to the improved treatment of the present day, the cicatrix is not now either as deep or as permanent as for-

merly. During the eruption there is always more or less burning and itching of the skin.

The eruption is classed, according to its nature, as discrete, confluent, or hemorrhagic. In the first, the pustules remain separated, and dry up by the thirteenth or fifteenth day. In the confluent type, the pustules increase in size and run together. The swelling around them is more marked than in the discrete type, as are also the pain and the itching. The patient often dies of sepsis in a few days. If he survives, the pustules dry up during the third week and the resulting crusts will probably be off by the end of the fourth. There are two varieties of the hemorrhagic type known as:

1. Purpura variolosa. The onset is severe, there is bleeding from all the mucous membranes, and the patient often dies before the appearance of the rash.

2. Variola pustulosa hemorrhagica. The eruptions are of the confluent type with hemorrhage into the pustules. These cases seldom recover.

Temperature.—The temperature rises rapidly after the initial chill to 103°–105° F., and remains high until the eruption appears. It then falls, remaining lower (99°–101° F.), till the pustules form, when it gradually rises, reaching its height about the ninth day. In mild cases, lysis then begins, but in severe cases the temperature will remain high for some days longer. The leucocytosis is high.

Complications.—The possible complications are septicemia, pyemia, empyema, myocarditis, nephritis, pharyngitis, abscesses, and cellulitis of the skin and subcutaneous tissue.

Varioloid.—Varioloid is a mild form of smallpox, which attacks those who have been vaccinated. The

invasion is much the same as in smallpox, but the symptoms are all milder. The eruption is less in quantity and degree, and the secondary fever is slight.

VACCINATION (see Chapter XXII.).—Vaccination should be performed in infancy; again, about the seventh year; in early adult life; and during epidemies, or after exposure to smallpox, when such exposure occurs more than five or seven years after the last vaccination.

NURSING.—The strictest quarantine must be observed from the onset till the falling of the last crust. The pus from the sores should be cleansed by sponging with disinfectants. Itching can be much relieved by frequent sponging and by soaking the crusts in oil or vaseline. To prevent pitting, the patient must be restrained from scratching himself. This is best accomplished by encasing his hands in gloves, tying his wrists so that the face cannot be reached, and fitting a mask of lint over his face. The mask and gloves are kept constantly moist with different antiseptic solutions or ointments.

The eyes should be irrigated every two hours and the mouth, as in all communicable cases, cleansed after and before each feeding. Fresh air and cleanliness are of more than ordinary importance.

Syphilis

Syphilis is a chronic infectious and constitutional disease caused by the spirochete pallidum. It is a disease that is cured with difficulty and may attack any, or every, organ of the body.

It may be congenital or acquired. When the dis-

ease is inherited, the symptoms may appear immediately after birth, but more commonly they come on about the second month. The skull shows prominent frontal eminences, and there is thickening around the anterior fontanel. A rash appears, usually erythematous in character, but sometimes papular or pustular. Ulcers will form on the mucous membrane. There will probably be a more or less purulent discharge from the nose, eyes, or ears, and in female children from the vagina. The child invariably has the snuffles, is thin, marasmic, and looks old. During this stage it can infect others.

When such children live they are liable to be epileptic, idiotic, or hydrocephalic. When the permanent teeth appear, the upper central incisors are small, conical, and notched at the end ("Hutchinson teeth"). There will probably be keratitis, iritis, or deafness. Gummata may form in the viscera, and there may be periosteal nodes on the long bones.

Syphilis may be acquired by direct contact with some one suffering from it, or by using linen, dishes, or utensils used by such patients and not disinfected. The disease is infectious in the primary and secondary stages. The germ is in the blood, and in secretions from sores and mucous patches; these, therefore, are the source of infection. Nurses attending obstetrical or gynecological cases complicated by syphilis are particularly liable to infection unless they exercise the greatest care.

Incubation.—The period of incubation is about three weeks.

Symptoms.—Stages. There are three distinct stages in the disease. In the first stage there appears at the point where the germ enters the body, a small

hard lump which soon ulcerates. Later this heals slowly, but a permanent scar is left. This sore is variously known as the *initial lesion*, the *chancre*, and the *primary sore*. There may be no constitutional symptoms during this stage but the glands, especially those of the inguinal region, sometimes become enlarged.

The secondary stage begins from six to twelve weeks after the appearance of the initial lesion; it may continue either for a few weeks or for two or three years. It is marked by eruptions of various types; mucous patches[1] upon the mucous membranes of the mouth, nose, anus, or vulva; and various constitutional symptoms, such as slight fever, general malaise, headache, disturbance of the digestive organs, anemia, iritis (and other inflammations of the eye), otitis media, deafness, pain in the bones, particularly at night, and a falling of the hair.

The third or tertiary stage does not always begin immediately after the symptoms of the second abate, and with proper treatment it may sometimes be avoided. In this stage there may be various skin lesions. Of these, the papillomata and indolent ulcers with scaly crusts that after healing leave deep scars are especially common. Infection can be contracted from the discharge of these ulcers, otherwise there is no danger of contagion in the tertiary stage. Gummata may appear in any part of the body. Periosteal nodes form on the bones, especially on the shins. The bones of the nose may necrose, causing a sinking in of the bridge of the nose. There may be ulceration and necrosis of the laryngeal cartilages and

[1] The tissue is moist, swollen, and covered with a grayish film.

vocal cords, with perforation of the hard or soft palate.

NURSING.—During the contagious stages, the disinfection usual in other infectious diseases should be carried out, and nurses should be particularly careful of their hands. Infection is frequently acquired by failure in this respect. Rubber gloves should be worn when giving inunctions, doing dressings, douching, etc.; mercury, potassium iodid, and arsenic are the drugs generally used in the treatment of syphilis. The preparation of arsenic commonly used is that known as *salvarsan* and 606, the latter name being the number of experiments tried in finding a means of giving arsenic in a strong enough dose to kill the spirocheta without killing the patient. Salvarsan is usually given in the same way as a hypodermoclysis, the fluid may be injected into a vein, the subcutaneous tissue, or the muscles.

Tetanus

The specific cause of tetanus is the bacillus tetani, which enters the body through wounds or abrasions in the skin and mucous membrane. The germ is a natural habitant of the intestines of animals, especially horses, and is therefore often found in the soil, particularly that fertilized, or soiled, by manure. That the disease is not more common is due to the fact that it requires to be deeply embedded in the tissues in order to develop. Wounds made with toy pistols have always been attended with a high per cent. of tetanus infection, because the germs, which the child has gotten on his hands from the soil, are driven deeply into the tissue when the wound is made. The germs

remain in the wound and do not invade the body, but they produce a very powerful toxin which is absorbed by the blood. The horrible convulsions characteristic of this disease are due to the action of this poison.

INCUBATION.—The period of incubation is one day to three weeks.

SYMPTOMS.—The onset is gradual. There is a growing rigidity of the muscles of the neck and jaw, which spreads slowly to the trunk and legs. The arms are seldom involved. As the rigidity increases, spasmodic contractions of the muscles develop and increase in intensity, until convulsions occur upon the slightest stimuli, such as a noise, a touch, a light, jarring the bed. The convulsions may be so severe that the body will become arched and the patient rest on his head and heels. The respiratory muscles may become so rigid that they will not work and the patient will die of suffocation. The paroxysms are of varying duration, but even when the body is not in actual spasm, the muscles are rigid and tense. The death-rate is about 80 per cent.; death usually occurring within four days.

TEMPERATURE.—The temperature is variable. In mild cases there is sometimes only a slight elevation. Ordinarily it runs between 103° and 105° F., but in some cases it may be higher, and is frequently 110° F. and over before death.

TREATMENT.—When the tetanus antitoxin can be procured, a patient whose wound has been received under conditions favorable to infection by the bacillus tetani is given a dose of antitoxin as a preventative measure, and the wound is thoroughly cleansed and kept open for drainage. If the patient is not seen by the physician until the symptoms have developed

the wound is opened, curetted, and irrigated. Bromids, chloral, or other medicine that has antispasmodic power is given and, during convulsion, chloroform.

Nursing.—Absolute quiet and darkness are two of the most essential specific points in the nursing. Either nasal or rectal feeding is resorted to when necessary, and, to prevent convulsions, it is frequently necessary to keep the patient under the influence of chloroform during the process.

Tuberculosis

The specific cause of tuberculosis is the bacillus tuberculosis.[1] The germ is found in the lesions and in the discharge from the seat of infection. Any part of the body may be affected. In children, the most frequent sites of the disease are the bones, joints, lymph nodes, peritoneum, and meninges; in adults, the lungs.

Reason for Name and Condition of Lungs.—Tuberculosis was so named because it was found that wherever the tubercular bacilli lodged—in the air-cells of the lungs for example—the surrounding tissue thickened, forming a small tumor or tubercle about the invaders. This defensive action on the part of the body often kills the bacilli, but the tubercle will remain and become hardened into a small fibroid, chalky mass. If, however, the bacilli survive, the toxin which they produce causes the disintegration of the tubercle into a soft cheese-like mass. Nature still continues the fight, however, and forms a tissue wall around this, consequently, unless the organisms

[1] Discovered by Koch in 1881.

are overcome, the tubercles slowly become enlarged and others form. Then the mass gradually breaks down and is—in pulmonary tuberculosis—expectorated, so that in time a cavity is formed in the lung. If the blood-vessels are injured in the course of this disintegration, there will be hemorrhages, the blood being expelled through the bronchi and mouth. If the bacteria be overcome and the process arrested, the tubercles and cheese-like masses become hardened or calcified and the scar-tissue contracts so that if any cavity exists it becomes smaller.

How Infection Takes Place.—The source of infection is the sputum, saliva, and nasal discharge of tubercular persons. Infection may take place by inhalation or through the skin or digestive apparatus; the latter it is thought is the most common path of entry. The bacilli do not necessarily cause trouble in the part of the body where they first lodge; but may pass into the blood-vessels and be carried to some other part of the system. The lymph glands are particularly likely to become infected, for, when bacilli are absorbed by the blood or lymph, these glands endeavor to retain and destroy them.

Origin of Infection.—That tuberculosis is so wide-spread is largely due to the intolerably filthy habit that some people have of expectorating on the ground. Minute particles of the expectorated matter, which contain thousands of bacilli, may be blown about and lodge on food, or be inhaled; flies may rest upon the expectoration and later upon food. Other common sources of infection are public drinking cups, towels, and the like, for people with tuberculosis are more than likely to have germs upon their lips and, unless they are very careful when using their hand-

kerchiefs, upon their hands; therefore towels, cups, etc., used by them are very likely to become infected. Kissing is another means of transmitting the disease. Infection is the more easily spread by these means in that, except in severe, acute attacks of tuberculosis, the patient may not have any symptoms sufficiently severe to send him to a doctor for months after he has become infected and a source of danger to others. Many individuals have a short attack of tuberculosis and never know it. This fact is constantly demonstrated in the autopsy room; small calcified tubercle and scar tissue being frequently found in the lungs of patients who have died of other diseases and have given no history of having had tuberculosis at any time.

PREDISPOSING CAUSES OF TUBERCULOSIS.—These are: debility of the system from any cause; diseases of the lungs; injury of the part of the body in which the infection takes place; living amidst unsanitary surroundings, as, for instance, where there is a lack of sunshine and fresh air.

DIFFERENT FORMS OF PULMONARY TUBERCULOSIS.—Pulmonary tuberculosis may be either chronic or acute. The acute form, at the beginning of the disease, often resembles lobar pneumonia and is then known as *tuberculous pneumonia*. The form the disease takes depends upon the number and virulence of the germs causing the infection and the degree of resistance that the individual's body is able to offer.

Symptoms of Chronic Pulmonary Tuberculosis.—These are loss of appetite, profuse perspiration, especially at night; progressive emaciation and weakness; a short hacking cough, sometimes accompanied with pain in the lung, and a muco-purulent sputum con-

taining the specific germ; a hectic flushing of the cheeks particularly towards evening; anemia; occasional attacks of diarrhea and vomiting. The temperature generally runs a typical course, being comparatively low in the morning and rising towards evening. The pulse is soft and rapid. As cavities form in the lung the symptoms increase in severity; there are apt to be chills and hemoptysis. The patient is always hopeful of recovery.

If the infection be slight or the individual in a fairly healthy condition at the time of infection, these symptoms will develop very slowly, and if the condition is recognized early there is every hope of recovery. Or, sometimes, though the disease may not be entirely cured, the process will be arrested and, with proper care, the patient live for years and enjoy fairly good health.

Acute Pulmonary Tuberculosis.—The symptoms are the same as in the chronic type, but they are more pronounced and the patient usually becomes very ill soon after their first appearance. Death is likely to occur within a few weeks or months, or the severity of the symptoms may subside and a chronic form of the disease follow, or the patient may recover; but the outlook for a permanent recovery is less hopeful than when the onset of the disease is less sudden.

Tuberculous Pneumonia.—Tuberculous pneumonia begins much like a lobar pneumonia, but defervescence fails to take place. Night-sweats and other tubercular symptoms come on, and the tubercular bacilli will soon be found in the sputum. Death occurs in the majority of cases in from two to eight weeks; in others, the symptoms abate and a chronic phthisis ensues.

Acute Miliary Tuberculosis.—This form of the disease is supposed to be due to the rupture of a tubercle or infected lymph gland into a vein; in consequence of which bacteria are carried all over the body and start up tubercular processes in many or all of the organs, so that the patient becomes thoroughly poisoned. The symptoms closely resemble those of typhoid fever, with the addition of others the nature of which will depend upon the organs that are principally affected, *e. g.*, there will be dyspnea, cough, and expectoration if the lungs are the chief seat of the infection; headache, convulsions, and other symptoms of meningitis will occur if the principal lesion is in the brain; and pain, diarrhea, and abdominal distention, if it is in the intestines and peritoneum. Death occurs within a few days or weeks.

Tubercular Meningitis.—This form of tuberculous infection resembles cerebrospinal meningitis in many respects, but the head is, as a rule, less retracted, the course of the disease is slower, and the fever moderate and irregular. The tubercle bacilli are found in the cerebrospinal fluid obtained by lumbar puncture. Such patients rarely recover.

Bone and Joint Tuberculosis.—As previously stated, during childhood the bones are particularly likely to become the seat of infection by the tubercle bacilli. Tubercles are formed in the bone in much the same manner as in the lung and, unless the process can be arrested, the bone will become necrotic. The hip and spine are common locations of the trouble. When the spine is the affected part the condition is known as Pott's disease. Some of the important symptoms of the bone infection are swelling, deformity, stiffness, impaired motion, pain. Also, there

is likely to be lack of appetite, emaciation, and more or less fever, especially in the afternoon. A tuberculin test and the X-rays are now often used in making diagnosis.

Treatment.—Immobilization or support by a cast or brace, outdoor life and good food, keeping the bowels regulated and the child clean and in hygienic surroundings are the essential features of the treatment. If suppuration occurs operative measures are resorted to.

Tuberculosis of the Lymph Glands.—This is one of the commonest forms of tuberculosis in childhood, and is due to the fact that the lymph nodes act as filters for the body, so that solid substances such as bacteria are caught within the meshes of the gland tissue. If the bacteria are not destroyed by the phagocytes, infection of the gland is likely to follow. The cervical glands, it is thought, often become infected through the tonsils.

Treatment.—If the child is properly fed (see Chapter XXVI), spends a great part of its time in the open air, and lives amidst hygienic surroundings, there is every chance that the process will be arrested, but if suppuration occurs, operation will be necessary. Keeping the patient's mouth clean by using an antiseptic mouth wash at least three times a day is an essential part of the care when the glands of the neck are affected.

Prophylactic Measures.—To prevent children contracting this or any other form of tuberculosis every child should be taught: not to put its fingers, pencils, money, etc., in its mouth; not to take chewing gum, candy, fruit, that another child has had near its mouth; not to use another child's whistle nor any-

thing that is put into the mouth; not to wet its fingers in its mouth when turning the leaves of a book; not to use public drinking cups nor towels; to wash or peel fruit before eating it; to hold a handkerchief in front of its mouth and nose when coughing or sneezing.

Nursing.—Careful disinfection of the specific discharge is necessary to avoid the spreading of the disease. Disinfection of the bedclothes and, in pulmonary tuberculosis, of all dishes used for eating and drinking is advisable.

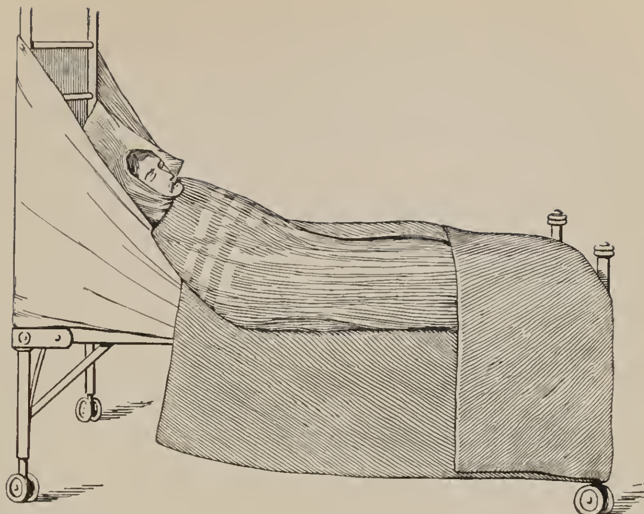
When possible sputum cups which can be burned should be used. When these cannot be obtained, porcelain cups, half filled with carbolic solution 1:40, or other disinfectant, should be used. These cups must be kept covered, emptied frequently, and boiled daily. Pieces of gauze and old linen that can be burned after use are preferable to handkerchiefs. A constant supply of fresh air, cleanliness, and nourishing food are the other most important points in the nursing of tuberculosis. When possible, the patient should be kept out-of-doors all day, and even all night when a sheltered place can be provided.

Open-Air Treatment.—The special points for a nurse to remember in the open-air treatment are that the patient must be protected from draughts and be kept warm. In cold weather a hot-water bag should be kept at his feet and outing-flannel sheets, pillow-cases, nightgown, and cape with hood should be used. The patient is to be wrapped up before he is taken into the cold air and should be brought under cover whenever it is necessary to do anything which will entail loosening the covers.

When it is necessary to use many or heavy blankets, means must be taken to prevent their weight incommoding the patient. This is sometimes done by using rather stiff bolsters, which are the length of the bed, but only large enough in diameter to be about one half or one inch higher than the patient's chest and abdomen when he is lying on the bed. They must not be higher or the clothes will not touch the patient and he will feel cold. The bed is made as follows: One large blanket, or two smaller ones sewed together, is put under the mattress (see Fig. 91); in very cold weather it is well to put also a rubber sheet under the mattress—this should be just the size of the latter. The mattress is covered with a sheet and draw sheet as usual, but, if possible, the rubber sheet under the draw sheet is omitted. A bolster, in an outing-flannel case, is put on either side of the patient. The sheet and blankets used to cover the patient are tucked under the mattress and the ends of the blanket that is under the mattress are folded over the patient as shown in Fig. 91. A dressing towel is laid across the upper part of the patient's chest to protect his face from the blankets. At least three pillows are used, two of them placed slantwise, on either side of the patient, in such a way that they will protect his neck and shoulders. The third is laid across the upper corners of these, under the patient's head.

When the patient cannot be kept out-of-doors, the windows of his sleeping-room must be kept open, and the bed be so placed that he will get the full benefit of the incoming air, but, at the same time, be protected from draughts.

When a tubercular patient is not too weak or is



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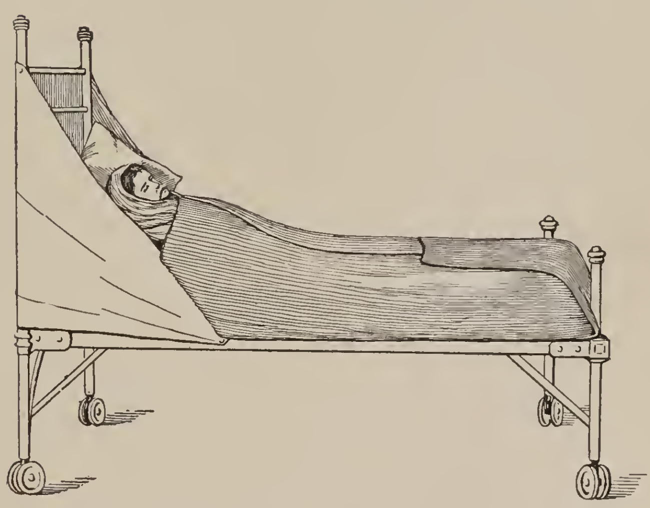

FULLY ADJUSTED

FIG. 91.—BED DRESSING

not running a high temperature, the doctor usually wishes him to have excrcise, but he must not be allowed to over-exert himself and become tired.

Typhoid Fever (Enteric Fever)

Etiology.—Typhoid fever is an infectious discase caused by a germ called "Elberth's baeillus typhosus." In autopsy it has been found in the lymphoid tissue of the intestines, the mcsenteric glands, the spleen, livcr, and kidneys.

Infection is by mouth. Typhoid can be transmitted by anything that has come in contaet with any of the discharges containing thc germ, provided the objcct has not been propcrly disinfected.

Lesions.—The principal seat of inflammation is the ileum, particularly that portion in whieh thc glands of Peyer ("Pcyer's patches") are situated. The symptoms that occur during the disease, however, are due, not to the process going on in the intestine, but to the toxins claborated by thc bacteria.

Incubation.—The period of incubation is two to three weeks.

Primary Symptoms.—The primary symptoms are headache, nausea, pain in back, legs, and abdomen, loss of appetite, coatcd tongue, epistaxis, diarrhea.

Later Symptoms.—The later symptoms are thc enlarged spleen, Widal's reaction,[1] rash, and liquid yellow stools with a "pea-soup" appearance. There may be either diarrhea or constipation.

[1] Widal's reaction was discovered by Widal in 1890. A drop of blood serum taken from a suspected typhoid patient is mixed with one drop of a culture of typhoid bacilli. As a rule, if the patient has typhoid the bacilli in the media will within a few minutes lose their motility and collect in clumps.

Temperature.—During the first week the temperature rises steadily, being a degree or a degree and a half higher each evening, and higher each morning, generally reaching 103° or 104° F. by the end of the first week. During the second week, the fever remains continuously high with but slight morning remissions. In the third week, these remissions become more marked, and, in favorable cases, there is a gradual decline of the fever, the temperature in mild cases even reaching normal by the end of the week. In the majority of cases, it does not, however, do this until the fourth week, and in some cases not even then. It is always a serious symptom when the temperature and other symptoms do not abate by the end of the fourth week. In such cases, convalescence may be deferred till the fifth or sixth week and complications are likely to occur. A sudden drop of temperature at any time during the disease, unless the pulse rate decreases in proportion, is to be regarded with suspicion, as it is a symptom both of hemorrhage and perforation.

The Pulse.—The pulse in typhoid is, normally, very slow in proportion to the height of temperature; the usual rate being between 80 and 100. A sudden quickening of pulse rate is likely to be due to hemorrhage, perforation, or weakening of the heart.

The Tongue.—The tongue is at first coated and white. Later it becomes almost black in the center and very dry. When the tongue begins to clear at the edges and to grow moist, the approach of convalescence is indicated.

The Rash.—The rash, as a rule, appears first on the abdomen. It consists of small, scattered, rose-colored spots, that disappear temporarily on pres-

sure. It develops from the seventh to the tenth day, persists for two or three days, and then fades, leaving a brownish stain for a time. Successive crops continue to appear and fade, till about the middle of the third week. The spots are more abundant on the abdomen, the lower part of the chest, and the back, and sometimes are not present elsewhere.

Sudamina.—Sudamina may be present in some cases of typhoid. It has the appearance of small vesicles.

Mental Condition.—Typhoid patients are dull and stupid. They are apt to be delirious, though not violently so. They must never be left alone, as they invariably want to get out of bed. A continued low, muttering delirium with picking at the bedclothes is always a bad symptom.

The Spleen.—The spleen becomes enlarged in the very beginning of the disease. It can often be felt below the lower border of the ribs by the end of the first week.

Subsultus.—Subsultus or trembling is often present in severe cases. It is considered an untoward symptom.

Complications and Sequelæ.—Typhoid is likely to be complicated with, and followed by, many serious disorders. Those complicating the disease may occur at the seat of infection, *e. g.*, hemorrhage, perforation, tympanites; they may be due to the effect of the poison upon the system—heart dilatation, a not infrequent complication, is usually due to this cause; both complications and sequelæ may be due to the bacilli being carried by the blood to other organs and infecting them so that abscesses in various parts of the body may develop or endocarditis, empyema, perios-

titis, meningitis, pneumonia, inflammation of the eyes and ears, of the auditory nerve with consequent deafness, phlebitis, thrombosis, and a host of other troubles. Such sequelæ sometimes develop long after the patient has recovered from the primary infection.

The complications that the nurse must be particularly on the watch for are hemorrhage, perforation, heart failure, pneumonia, phlebitis, tympanites, bedsores, sore mouth.

Hemorrhage is most likely to occur after the beginning of the third week. As a rule, the hemorrhage is a capillary oozing and the symptoms of hemorrhage are not very marked; therefore, any increase in the pulse rate or unexpected fall in the temperature should be reported to the physician at once, and every stool must be inspected for signs of blood. The primary, diagnostic symptom of perforation is a sharp pain; it may or may not continue, therefore if the patient gives a sudden cry or complains of abdominal pain the doctor should be notified instantly, for when perforation does occur an immediate operation to sew up the ruptured intestine is the patient's only chance for life, and the sudden pain, which may be of only a moment's duration, will perhaps be the only symptom until the signs of collapse appear, and by that time the patient's condition may be too bad to allow of a successful operation. Perforation is due to the disintegration of the intestinal wall by the ulcerative process; hemorrhage to the breaking down of the walls of the blood-vessels in the ulcerated portions of the intestines.

Tympanites is a serious complication, because, if the intestines become distended with gas, hemorrhage and perforation are more likely to occur; also, if the

condition becomes marked, pressure will be made against the heart and interfere with its action.

Phlebitis, as a complication of typhoid, occurs most frequently in the femoral vein. The primary symptoms are pain and stiffness of the leg. Therefore, if a typhoid patient complains of pain in his leg, the fact should be reported; the leg must be kept quiet and never rubbed, for a thrombus is always likely to form in an inflamed vein and jerky movements or rubbing would be likely to dislodge the thrombus. The consequence of this was discussed in Chapter XX and on page .

Nursing.—Quiet is of the utmost importance in the nursing of typhoid fever. The patient must be kept absolutely at rest, in the recumbent position, only one pillow, preferably hair, being allowed. He must not be permitted to sit up and should not turn in bed unaided as any undue exertion puts an extra tax upon the heart and increases the danger of hemorrhage.

Baths.—Cold baths are nearly always used in the treatment of typhoid fever, and, when giving them, great care must be observed in moving the patient, especially when lifting him in and out of a tub. Undoubtedly, many cases of hemorrhage and perforation have been due to careless lifting and moving. In addition to the cold baths, warm cleansing baths must be given, at least twice weekly, and a cleansing bath should be given daily as soon as the cold baths are discontinued; it being important to keep the skin active in order to rid the body of waste products.

Care of the Mouth.—As in all other infectious diseases, it is most imperative that the mouth be

cleansed before and after every feeding. Improper care of the mouth may not only result in serious local trouble, but also in otitis media, infection of the salivary glands, tympanites, or re-infection of the patient. There are few other diseases in which neglect of the mouth shows so quickly; even a day's lack of care may bring about a condition that will be hard to rectify. Subsequent to the cleansing after feeding, an emollient must be applied to the lips and, sometimes, to the tongue to prevent their becoming dry and cracked.

Bed-Sores.—The danger of bed-sores is a point to be remembered when nursing typhoid patients; owing to the protracted high temperature, toxic condition, extreme emaciation, and general debility, the formation of bed-sores is more common in typhoid than in any other acute disease. As a preventive measure of both bed-sore and hypostatic pneumonia, it is often advisable to change the patient's position frequently. This must be done carefully, or hemorrhage or perforation may result. When a typhoid patient is very weak, a pillow should be placed against his back when he lies on his side.

Necessity of Water.—It is exceedingly important that typhoid patients be given frequent drinks of water in order that the system may be well flushed and the toxic condition thus lessened.

Enemata.—It being essential to keep the intestines as free as possible of feces, which are filled with bacteria and their toxic products, typhoid patients are usually given a cleansing enema daily. In giving the enema, caution must be observed to introduce the tube carefully and to regulate the flow of water so that it will enter the intestine very slowly.

Urine.—In typhoid, there is apt to be over-distention of the bladder, due to, at least, a partial retention of urine; the hours at which the urine is voided, and the amount, should therefore be charted and the patient encouraged to urinate every six hours.

Disinfection.—The disinfection in typhoid is of the utmost importance. The patient must be washed locally after every bowel movement. Patients and bedding must be kept scrupulously clean. All sheets, etc., removed from the beds must be put at once into a disinfectant or water. They must never be placed on chairs or tables or gathered up in the arms so that they will come in contact with the nurse's uniform. Nurses should be exceedingly careful not to touch anything—for instance, the screen, bed, door handle, soap, nail-brush—before disinfecting their hands. The methods of disinfecting have been already discussed at the beginning of this chapter.

Typhus Fever

Typhus fever is one of the most highly infectious diseases. It is both endemic and epidemic. It is essentially a filth disease, and occurs chiefly in dirty, overcrowded tenement districts. In former years, outbreaks of the disease were common in jails and camps, and it often followed times of famine.

Incubation.—The period of incubation is about twelve days.

Symptoms.—The symptoms are chill, rapid rise of temperature, accompanied by the usual febrile symptoms, intense headache, delirium, and a typical rash which appears on the fourth day. This rash comes out gradually and is very diffuse, especially upon the

chest, abdomen, arms, and thighs. It consists at first of slightly elevated, irregular, rose-colored macules which soon grow dusky in hue, lose their elevation, and become petechial.

Temperature.—The temperature remains continuously high during the first week. In the second week, its morning remissions are more marked, and on the thirteenth or fourteenth day it falls to normal. Convalescence is prompt.

Prognosis.—In severe cases the patient may die in three or four days, before the appearance of the rash.

Nursing.—The nursing is the same as in all febrile infectious diseases. An abundant, continuous supply of pure, fresh air is of the utmost importance.

Whooping-Cough (Pertussis)

The specific cause of infection has not yet been discovered, but it is probably given off in the breath and sputum. It enters the body through the respiratory tract. The disease is characterized by an acute catarrh of the mucous membrane of the respiratory organs and characteristic cough.

Incubation.—The period of incubation varies from four to fourteen days.

Symptoms.—In the first stage, which lasts from one to two weeks, the symptoms are those of an acute bronchitis with slight fever (101° to 102° F.). In the second stage, the fever subsides, the cough becomes more frequent and is often accompanied by paroxysms of breathlessness, cyanosis, bulging of the eyes, and distention of the veins. The cough frequently ends with a characteristic *whoop* caused by the spasmodic closure of the glottis. Vomiting and epistaxis are often induced by the paroxysms.

The cough is thought to be caused by irritation of the filaments of the pneumogastric nerve by the toxins produced by the microörganisms causing the disease. In mild cases, there may be only two or three paroxysms a day, while in others there are as many as fifty to eighty.

Complications.—The common complications are bleeding of the eye, nose, and throat, bronchopneumonia, and convulsions. Collapse of the lungs sometimes occurs in infants.

Nursing.—Isolate the patient from children until after the cough has ceased for some time. Disinfect his sputum. See that he is warmly but loosely clad. Keep him as much as possible in the open air, but if the paroxysms are severe, in bed.

Diseases Due to Animal Parasites

Ameba Coli.—This is a small protozoön that is more common in tropical and sub-tropical countries than in the north. The amebæ coli are taken into the body with drinking water and settle in the large intestine, where they burrow into the mucosa and multiply rapidly by cell division. Ulceration of the intestine results and consequent dysentery. The amebæ may also enter the portal vein and be carried to the liver where they will form abscesses. These may break through into the lung and the sloughing material be expectorated. The symptoms are those of dysentery; the patient has frequent, watery, offensive stools containing blood, mucus, and myriads of amebæ. Emaciation and anemia are soon marked; the temperature is likely to be subnormal. Occasionally the intestinal symptoms are not very marked, the amebæ

passing to the liver upon entering the body and causing few if any ulcers in the intestine.

Death often occurs within a few days from hemorrhage, perforation, peritonitis, or exhaustion. At other times the disease continues for months and either terminates fatally or in a long convalescence, or becomes chronic.

Diagnosis is made by finding the amebæ in the discharge. In order to recognize the amebæ it is necessary that they be alive, therefore the feces or sputum must be received into a warmed utensil and sent for examination at once.

Nursing.—The special point in the treatment is the irrigation of the bowel with a solution that is poisonous for the protozoön, *e. g.*, quinine or silver nitrate. As it is most important that the fluid be injected high into the intestine, the patient is usually placed in the knee-chest position, or if he is too weak for this, the foot of the bed is elevated during the giving of the injection.

Malaria

Malaria is an endemic, infectious disease caused by a unicellular animal organism. It is characterized by an enlarged spleen and by paroxysms of chill, fever, and sweating, which occur at definite intervals. A certain species of mosquito (the female of the *Anopheles maculipennis*) is now known to be the only vehicle of transmission.

Malaria is more prevalent in southern and tropical countries, and particularly so where the land is low, marshy, or badly drained. Malaria is more often contracted at night than in the day because most species of anopheles are nocturnal in their habits.

When the malarial organisms are injected into the blood they make their way into the red blood-corpuscles, each one taking possession of a different corpuscle. Here they grow, and after a few hours, the number depending upon the species of organism, each one splits up into some fifteen or twenty smaller ones, which break out of the corpuscles into the blood where they remain a short time and many of them die. Those which survive enter other red corpuscles and the cycle is repeated. It is when the small protozoa break loose from the corpuscles that the chill occurs.

There are three different types of malarial organisms. Of these, one variety is known as the *tertian parasite*, because it requires forty-eight hours to complete its cycle of development and thus splits up upon the third day of its existence, which amounts to every other day. Another type of malarial protozoön is known as the *quartan parasite*, because it takes seventy-two hours to complete its development and splits up on the fourth day. With either of these types of parasites there may be a double infection, and in the quartan parasite a triple infection, and if these come to maturity and segment on different days the patient will have a chill every day. This is known as *quotidian fever*. The third variety of parasite is called the *estivo-autumnal parasite*, because the type of malaria due to it is more common in summer and fall.

Symptoms.—In the tertian and quartan forms of malaria, the patient will have a chill every time the parasites break loose from the red corpuscles, which, unless there is a double infection, will be every second or third day, which depending upon the type of

organism. During the chill the temperature rises rapidly, even as high as 107° F., and when shivering ceases the patient feels intensely hot; both during and after the chill, there is likely to be headache and nausea and the pulse is frequent and hard. This stage usually lasts from one to four hours and is followed by profuse sweating, after which the temperature and other symptoms abate. On the days between the chills the patient usually feels fairly well unless he has repeated attacks. In such case, anemia will soon follow from destruction of the red corpuscles and loss of hemoglobin, and the disintegrated corpuscles and toxins produced by the parasites are carried to the liver and spleen and cause these organs to become congested and even diseased. The spleen becomes so much enlarged that it can be felt below the ribs, if the hand is pressed inward upon the left side of the abdomen. Unless the protozoa are destroyed they may increase to such an extent that they will block the small blood-vessels in various organs and cause congestion of those parts. Also, if the protozoa are allowed to propagate to any extent they will be hard to destroy, for they may enter and remain in the spleen for years and cause recurrence of the disease every time conditions become favorable, as for instance when the patient is suffering from some other disease or becomes debilitated from any cause.

Estivo-autumnal malaria occurs principally in tropical and sub-tropical countries. It is a more serious type of the disease than that caused by the tertian or quartan parasites. The chills usually are less marked and occur less regularly than in the other types of the disease, and after a few days the fever becomes remittent, instead of intermittent.

The destruction of red corpuscles is very marked, as is also the congestion of the spleen and, often, the other organs, especially the liver and kidneys. The patient is likely to become jaundiced, emaciated, and prostrated. The toxemia may be extreme and the patient will then have much the same appearance as in typhoid.

Pernicious Malaria.—This form of malaria, known also as black-water fever, because of the dark color of the urine resulting from the large quantities of hemoglobin discharged in it, is likely to follow any of the other forms of malaria if the protozoa are allowed to propagate unchecked. Bad infections by the estivo-autumnal parasite are very likely to produce this form of the disease. The toxemia and consequent mortality are great.

Prophylaxis. Treatment. Nursing.—The means of preventing the spread of malaria have been already discussed. The usual treatment consists in the giving of large doses of quinine—20 to 30 grains—about an hour before the time for the chill, so that it will be in the blood when the young protozoa burst from the ruptured corpuscles and thus poison them. After the chills cease to occur the dose is lessened to 5 or 6 grains a day, but it is usually considered that this much should be taken for some time after an attack, how long depending upon the length of time required to check the chills and whether or no the individual remains where he is exposed to the infection. The patient should be kept in bed until the chills cease to occur, for rest and building up of the system with nourishing food help greatly in overcoming the infection. The bowels and kidneys must be kept active.

Nursing.—During the chill, keep the patient well covered, having a blanket next his body. Place hot-water bags at his feet, in the axilla, and over the heart. Give hot drinks, un'ess there is nausea. During the hot stage, apply cold compresses to the head, and, unless the patient is ordered sponge baths, give frequent alcoholic rubs. In this disease the patient should be screened to keep out the mosquitoes so that the infection be not carried to others.

Yellow Fever

Yellow fever is a disease peculiar to tropical and semi-tropical countries. It is transmitted by means of a specific mosquito—*Stegomyia fasciata.*

Incubation.—The period of incubation varies from a few hours to five days.

Symptoms.—The invasion is acute, beginning, as a rule, with a chill, or, in children, with convulsions. The temperature rises, during the chill, to 103°–104° F. There is muscular pain, especially in the legs and lumbar region, jaundice of the skin and conjunctivæ. The eyes look watery, glazed, and sunken. Albuminuria appears early in the disease, but usually clears up as soon as the other symptoms subside. There may be hemorrhage from any part of the body. The "black vomitus" which is a frequent complication in severe attacks of the fever signifies hemorrhage into the stomach.

Temperature.—The temperature, except during and after the chill, is rarely very high even in extreme cases. As a rule, it falls shortly after the chill to 102° or 103° F., and remains so until the second, third, or fourth day, when it falls to about normal.

It remains thus for twenty-four to thirty-six hours, and then rises to 102° or a little above. If recovery takes place, it subsides—either by crisis or lysis—in a day or two.

THE PULSE.—During the initial fever, the pulse varies from 90 to 115, but during the secondary fever, unless hemorrhage takes place, it is generally comparatively slower. It may be exceedingly feeble.

Suppression of urine and hemorrhage are the two most dreaded features of the disease. The hemorrhage may occur in any part of the body.

NURSING.—The specific points to be remembered are: the necessity of keeping the patient quiet, to lessen the danger of hemorrhage; doing everything possible to relieve the muscular pain, which is at times intense—hot applications, counter-irritants, and massage are the treatment most frequently ordered for this purpose; and watching the quantity and quality of the urine. The patient should be kept screened from mosquitoes to avoid the spreading of the disease.

Convalescence is comparatively rapid in yellow fever, but there may be some irritation of the stomach, feebleness of the heart action, and lack of general tone for some weeks.

FILARIASIS.—Filariasis is caused by the *filaria bancroftii*. It is thought that this organism, like those causing malaria and yellow fever, is transmitted from man to man by means of the mosquito. The embryos of the organism, when injected into an individual by a mosquito, take up their abode in the pelvic lymph-vessels and there grow until they block the passage of the lymph. The symptoms of the disease will depend upon the location of the affected

vessels. If those which hold the lymph from the bladder are blocked, they are likely to rupture into that organ and the urine will be white like milk, from the presence of the chyle. If the involved vessels prevent the return flow from the superficial vessels of the leg the condition known as *elephantiasis* will result; *i. e.*, the skin and subcutaneous tissue become hypertrophied, the skin discolored, and, unless the condition is relieved, ulceration occurs. Blocking of any of the lymph-vessels is likely to cause a tumor-like swelling in the part where the stoppage occurs. The adult female parasite produces swarms of actively motile embryos, which find their way into the blood. These do no harm, however, since those produced in the human body do not grow large, and they help in diagnosis. The blood taken for examination of the filaria worm must be obtained about midnight, because the embryos of the more common form of this organism remain in the blood-vessels of the deeply seated organs during the daytime and enter the superficial vessels only when the patient is at rest, and they are likely to be present in greatest numbers about midnight.

The treatment consists in an operation for the removal of the worms blocking the lymphatics.

Ankylostomiasis or Uncinariasis.—This disease, which is very common in southern countries, is known also as hookworm disease, miner's anemia, and southern anemia. It is due to two different, though similar, forms of worms known as the *ankylostoma duodenale* and *uncinaria Americana*. These worms are about one-quarter of an inch in length. Their embryos exist in great numbers in the soil of certain localities and are probably taken into the mouth by putting the hands near it when they have soil upon them.

Also, the embryos enter the body by boring through the skin. Naturally, children, those working in the soil, and the unclean are the ones most likely to become infected.

The worms bite the mucous membrane and cause bleeding, in consequence of which severe anemia and malnutrition occur.

The usual treatment consists in giving thymol thirty grains—for an adult—repeating the dose in two hours, and, some hours later, giving a purgative.

Roundworm or Ascaris Lumbricoide.—This worm is from four to twelve inches long. It develops in the intestine from eggs which have been taken into the body with food or water. Usually, it remains in the intestine, but sometimes it crawls into the stomach and is vomited, and it has been known to get into the bile duct. The worm when in the intestine may, especially in children, cause nervousness and even convulsions, but it does not usually produce any local harm. If it gets into the bile duct, however, occlusion of the duct may follow.

The usual treatment consists in giving santonin one fourth to one half a grain, which will kill the worm, and following this with a purgative.

Tapeworms.—These are large flat worms. There are three varieties which can develop in the human intestine if the egg is swallowed with food: (1) The *tænia saginata* or *beef tapeworm* inhabits the intestines of infected oxen and its embryos pass into its muscles, so that if infected beef is eaten raw or imperfectly cooked, embryos of the worm are taken with it. The worm may grow as long as fifteen or twenty feet. This is the most common form of tapeworm in America. (2) The *tænia solium* or *pork tapeworm* is very common

in Europe, but it is seldom found in this country. It is taken into the body with infected pork. (3) The *bothriocephalus latus* or *fish tapeworm.* The embryos of this worm are in the flesh of infected fish. This form of worm is almost unknown in this country, but is common in parts of Europe and Asia.

The presence of tapeworm is diagnosed by finding segments of the worm in the defecations. Important symptoms of the presenee of a worm are progressive emaciation and anemia, nervousness, abdominal pain, indigestion. The treatment consists in restricting the diet to liquids for two or three days and at the same time ridding the intestines of solid matter by the use of purgatives; at the end of this time giving an anthelmintie—pumpkin seed infusion, turpentine, or oleoresin of aspidum are often used—and following this in a few hours with a cathartie.

When the tapeworm is passed it must be ascertained if the head is there, for, if not, the treatment will need to be repeated, the worm being able to grow again if the head remains in the intestine.

Trichiniasis.—This disease is caused by the *trichina spiralis*, a small worm that man becomes infested with by eating imperfeetly eooked pork containing the eneapsulated larvæ. The worms are set free from larvæ by the aeid of the gastrie juice and make their way into the mueous membrane of the intestine. Here they produee numerous embryos whieh soon enter the blood-vessels and are earried to all parts of the body. These embryos gradually settle, usually in the muscles, where they coil themselves up and in about six weeks beeome encapsulated just as they were in the flesh of the pig. After the organisms become encapsulated, they may eause no

further trouble, the danger lies while they are free. The severity of the symptoms produced during that time will depend upon the number of parasites ingested. If this is small, the symptoms will be slight, if large, the condition will be very serious, death often resulting. The symptoms appear within from a few days to about two weeks after eating the pork and consist in colicky pains, nausea, vomiting, diarrhea, muscular pain, edema of the face and sometimes of the larynx; in severe infections, the temperature and the patient's general appearance resemble typhoid.

Early diarrhea is favorable and if the condition is suspected soon after the infection and the intestines purged by cathartics and enemata, much can be done to avert further trouble, but after the embryos have passed into the blood the only treatment of avail is such as will keep up the patient's strength so that he will be able to withstand the result of the infection until encapsulation occurs.

Diseases due to animal parasites which infect the skin will be discussed under skin diseases.

Part II

NON-INFECTIOUS DISEASES

Constitutional Diseases. Diseases of the Brain, Spinal Cord, and Nerves. Of the Respiratory Organs. Of the Heart, Arteries, and Veins. Of the Blood and Ductless Glands. Of the Digestive Organs. Of the Urinary System. Of the Uterus and Appendages. Of the Muscles. Of the Bones. Of the Ear. Of the Eye.

Constitutional Diseases

The more common constitutional diseases are: diabetes mellitus, diabetes insipidus, gout, marasmus, rickets, rheumatism, scurvy.

Diabetes Mellitus—*Etiology.*—Diabetes mellitus is a disturbance of metabolism. It is characterized by the accumulation of glucose, or grape sugar, in the blood, and the excretion of it in the urine, which is voided in varying, but usually excessive, quantities (six to forty pints a day).

Symptoms.—The symptoms, in addition to the excessive micturition, are intense thirst, a continual craving for food, especially sweets, coated tongue, dry tongue, bad breath, intestinal disorders (constipation is more common than diarrhea), rapid emaciation, and loss of strength. Eczema of the vulva is very common in women and is sometimes one of the first symptoms. The urine is of a high specific gravity —1030 to 1050 and even higher.

Causation.—The cause of diabetes is unknown but it is thought to be frequently due to disease of the pancreas which interferes with the manufacture of its internal secretion, this secretion being necessary for the oxidation of glucose in the body. Predisposing causes are: sedentary habits, over-indulgence in drinking and eating, exposure to cold, wet, and fatigue, and injuries to the head or nervous system.

Complications.—The possible complications are albuminuria, diabetic coma, eczema, gangrene, pneumonia, and tuberculosis.

Prognosis.—Many victims die within two or three years, but old people sometimes live ten to twenty years with no other symptoms than the presence of sugar in the urine.

Nursing.—The diet is one of the most important points in the care of diabetic patients. This will be described in Chapter XXVI. Fresh air is imperative, but all draughts and sudden changes of air are to

be guarded against. A moderate amount of daily exercise is advised when the patient is able to take it.

Diabetes Insipidus.—The cause of this disturbance is unknown. It is characterized by the passing of a large amount of urine of low specific gravity; there are, however, no abnormal substances in the urine and no lesion of the kidneys has as yet been discovered. The condition may be present in early infancy or it may follow disease, injuries, or fright; it may disappear or it may be permanent. There is no special treatment. The patient is likely to be much troubled with thirst on account of the loss of water from the system, but the general health is little if at all affected.

Gout.—Gout is more common in middle life and in men. The predisposing causes are heredity, overindulgence in food and alcoholic drinks, chronic lead poisoning, lack of exercise, and lack of sufficient or proper food. It is characterized by an excess of sodium urates in the blood, due to the over-production or defective elimination of uric acid. Crystalline chalk-like deposits form in the cartilages of the affected joints, which sometimes necrose. In acute attacks of gout, there are pain and swelling. The pain is worse at night, it may, in fact, almost disappear in the daytime. The big toe is the joint that is generally first affected. The condition is attended with symptoms of indigestion and varying fever, 101°–103° F., and nephritis and arteriosclerosis are common complications.

Marasmus.—Marasmus is the name given to an extreme form of malnutrition. It occurs most commonly in children, and, as far as is known, without any constitutional or local disease. Improper feeding is

probably the predisposing cause in the majority of cases.

The symptoms are those of extreme malnutrition; the child fails to digest and assimilate its food and grows excessively emaciated. This condition is accompanied by anemia, a subnormal temperature, and anorexia.

Two exceedingly important points in the nursing are: (1) To keep the patient warm. (2) To give the food that he can best digest and assimilate. In order to accomplish the latter, it is necessary to examine and measure the stools and vomitus most carefully, to measure the food given, and to give it exceedingly slowly.

Rheumatic Fever (Acute Articular Rheumatism).—Rheumatic fever is an acute infectious disease, caused, it is believed, by a streptococcus. It is usually characterized by polyarthritis and inflammation of the fibrous membrane of the joints, resulting in pain and swelling of the same.

Predisposing Causes.—The predisposing causes are tonsillitis, exposure to cold and damp, and lack of proper nourishment.

Symptoms.—The disease sometimes sets in abruptly, but, as a rule, it is preceded by a slight malaise, pain in the joints, and sore throat. The affected joints become red, swollen, and painful. The joints are not all swollen at the same time, but, as the swelling subsides in one joint, it begins in another. There are apt to be profuse sweats, and the perspiration has a strong sour odor and acid reaction, owing probably to the large amount of lactic acid in the system.

Eruption.—Sudamina, or a red miliary rash, is often present, and sometimes purpura.

Urine.—The urine is scanty, highly colored, and strongly acid.

Temperature.—The temperature varies from 102° to 104° F., with marked remissions. Defervescence is gradual.

Pulse.—The pulse is generally frequent and weak. Its character must at all times during the disease be carefully noted, as cardiac complications are likely to occur.

There will be a marked leucocytosis.

Course.—The attack may last for weeks. The swelling often disappears for a day or two, and then a relapse occurs.

Complications.—The possible complications are endocarditis, myocarditis, pericarditis, tonsillitis, and anemia.

Nursing.—The general treatment is the same as in all fevers. Local applications are generally ordered, and care must be taken when applying them to move the extremities as gently and as little as possible, for every movement is painful in the extreme. The extremities are often immobilized by the application of splints, sand-bags, or pillows, and they should be protected by "cradles" from the weight of the bed-clothes. Flannel sheets and nightgowns, owing to the excessive perspiration, are often preferred to cotton and, unless it is too painful for the patient, they should be frequently changed. The patient should be moved as little as possible and should never be allowed to exert himself in the least, for anything that will give the heart extra work is to be avoided. Care must be taken not to jar the bed, nor to allow any sudden noise, such as slamming of doors or window shutters, to startle the patient.

Chronic Rheumatism.—Chronic rheumatism may come on gradually, or it may follow an attack of rheumatic fever. It is characterized by changes in the joints, due to thickening and contraction of the fibers, which frequently result in deformity and loss of motion.

Temperature.—Slight febrile attacks may occur from time to time, but there is no constant high temperature.

Nursing.—Hot-air baths, local douching, and massage are the general local treatments. Protection against cold, wet, and sudden changes of temperature, and seeing that the patient has proper food and warm clothing are the most important points in the nursing.

Muscular Rheumatism (Myalgia).—In muscular rheumatism, the irritation is localized in various muscles and there is little constitutional disturbance.

According to the group of muscles affected, the disease is known as: torticollis (muscles of the neck), pleurodynia (the intercostal muscles), lumbago (muscles of the back, especially those in the lumbar region), cephalodynia (muscles of the scalp).

Treatment.—The treatment generally consists in the application of heat, counter-irritants, and massage.

Rickets (Rachitis).—Rickets is a disease of malnutrition that is supposed to be due to a lack of fat, proteid food, and salts. It occurs generally in bottle-fed babies and in children of the tenements. There is a lack of lime salts in the bones, which are consequently flexible and often misshapen. In severe cases the abdomen is distended partly because of enlargement of the liver and spleen and partly because the intestines are distended with gas. Such children

are late in learning to walk and talk and are particularly susceptible to disease and attacks of convulsions.

Nursing.—As in all diseases of malnutrition, fresh air, cleanliness, and wholesome, easily digested food are of primary importance. In rickets, food rich in mineral matter, such as fruit juices, and, if the child is old enough, vegetables and rare or uncooked beef should be given. Massage is often ordered, as massage and proper manipulation of the extremities will do much toward correcting any tendency to deformity due to the lack of firmness of the bones. Children with rickets should be kept off their feet and trained to sit and lie straight.

Scurvy.—Scurvy has been variously classed as a disease of the blood, of malnutrition, and of infection. The chief predisposing factors are lack of fresh air and vegetable food; excessive use of salt meats. Infantile scurvy occurs chiefly in children who have been fed on sterilized or condensed milk or proprietary foods. The principal symptoms are emaciation, weakness, indigestion, and purpura. The gums are swollen and bleed easily, the teeth are loosened, the tongue is swollen, the breath is foul, and in children, especially, the lower ends of the femur and the tibia are swollen from subperiosteal bleeding.

Nursing.—Frequent baths, scrupulous care of the mouth, and the provision of fresh air and of food rich in salts, especially fruit juices, are the main points in the treatment.

Diseases of the Brain, Spinal Cord, and Nerves

Abscess of the Brain.—The most frequent causes of abscess of the brain are: inflammation of the middle

ear, mastoiditis, caries of the bones of the nose or skull, infected wounds of the skull, and certain infectious diseases—such as influenza, sepsis, erysipelas, and infected emboli.

Symptoms.—If the infection is severe, there is likely to be high fever, chills, intense headache, delirium, convulsions, vomiting, and coma. When the infection is not severe the pus may become encapsulated and the symptoms will be less pronounced and will come on gradually. There is likely to be headache, vertigo, nausea, irritability, mental impairment, loss of flesh and strength, defective functioning power of the part provided with nerves that are connected with the part upon which pressure is made by the abscess.

Treatment.—When possible, an operation is performed for the evacuation of the pus.

Apoplexy.—The condition generally known as apoplexy is due to the rupture of a blood-vessel in the brain. Arteriosclerosis is the common predisposing cause. The exciting cause may be anything which leads to an increased blood pressure such as overexertion, excitement, overeating, and overstimulation.

Symptoms.—Sudden vertigo, faintness, and disturbed speech, followed by coma. The face becomes flushed and dusky, or, in very severe cases, ashy pale. The breathing is stertorous, slow, irregular, and often Cheyne-Stokes. The pulse at first is soft, slow, and compressible, but later full, rapid, and bounding. The eyes are fixed and staring, the pupils varying, but generally unequal. There may or may not be convulsions.

The patient may die within a few days or hours;

he may partially recover and then relapse, or he may recover. As he regains consciousness a paralysis will be observed, the form depending upon the seat of the lesion.

Treatment.—The patient should be put in the recumbent position, his clothing loosened, the head of the bed elevated, and ice applied to his head.

Chorea (St. Vitus's Dance).—The cause of chorea is unknown, but it is thought that it may be due to germ invasion, because it so often occurs in connection with, or following, tonsillitis, endocarditis, and acute rheumatism. It is most common between the fifth year and puberty and in pregnancy. It is characterized by involuntary contractions either of single muscles or of groups of muscles, the force and frequency of which may be slight or very severe. The movements are generally absent during sleep and are always increased by attention, emotion, or fatigue.

Nursing.—Nourishing food, fresh air, freedom from excitement and fatigue, are the special points for the nurse to remember. Severe cases are kept in bed, and it is often necessary to bandage the extremities to keep them from becoming chafed. Sedatives may be needed and are frequently prescribed.

Epilepsy (Falling Sickness).—Epilepsy is characterized by periodic attacks of unconsciousness which may or may not be associated with convulsions. When there are no convulsions the condition is often spoken of as the *petit mal;* when there are convulsions, as the *grand mal.*

One form of epilepsy, known as *Jacksonian epilepsy*, is the result of cerebral lesions and a cure can often be obtained by the removal of the cause. In *idiopathic epilepsy* there is no discoverable cerebral lesion,

and it is thought that in such cases the disease is often the outcome of reflex convulsions that occurred in childhood due to gastric irritation, worms, etc., and which have established, through constant repetition, a condition in the nervous system that causes this special form of spontaneous motor activity upon slight provocation. Epilepsy is more likely to occur in the children of neurotic and intemperate parents. It usually manifests itself before puberty and rarely after the twenty-fifth year. The younger the child is, the less hope there is of recovery; other things which cause the prognosis to be unfavorable are frequent attacks and a tendency to develop maniacal symptoms at the close of the attack.

Symptoms.—There is generally some premonitory symptom of the onset of an attack, known as the "aura," the nature of which varies in different individuals. It is followed shortly by a loud cry and the patient becomes unconscious. In a few minutes convulsive movements begin, slight at first, but gradually increasing in intensity; all parts of the body are involved. The face is cyanosed, the respiration irregular and noisy, and the pupil reflexes are lost. The convulsion subsides in a few seconds or minutes. The patient may then pass into a state of coma, remaining so for several hours, or he may regain at least partial consciousness at once.

Nursing.—In all cases of convulsions, a nurse should take means to prevent the patient from biting his tongue, by forcing a folded handkerchief or piece of wood between the teeth, or from otherwise hurting himself. She should also observe carefully the parts of the body involved in the convulsion, since this knowledge is an important aid to the physician in

localizing the seat or diagnosing the cause of the trouble.

Herpes Zoster (Shingles).—Herpes is an acute inflammation of the ganglia that are on the sensory nerves where they leave the spinal cord. Herpes is always limited to one side of the body. It is accompanied by acute neuralgic pain in the intercostal, lumbar, or supra-orbital nerves, and a vesicular rash—like a "cold sore"—which appears on the area of skin supplied with nerves from the affected ganglia.

Hydrocephalus.—Hydrocephalus—water on the brain—is due to excessive secretion of cerebro-spinal fluid. In children this causes separation of the cranial bones with consequent enlargement of the skull. The condition may be congenital, or it may occur in meningeal diseases, in cachexia, and in old age. In congenital cases, the fontanels fail to close, the head is abnormally large, and the forehead bulges, making the face look small. Children thus afflicted are never bright. They are liable to have frequent attacks of eclampsia, and death generally occurs in from one to four years.

Hysteria.—Hysteria has been defined as "a functional neurosis which causes a defect in the controlling power of the psychic centers." The predisposing causes are continued over-fatigue either of mind or body, combined with an early training which has failed to teach self-control and unselfishness. The children of neurotic parents are more especially susceptible.

Attacks of hysteria take many forms. For instance there may be unconsciousness which often lasts many hours, or even days; convulsions; catalepsy of an extremity, *i.e.* if an arm, for example, is placed in a

certain position, it will remain so, even for hours; localized hyperesthesia or anesthesia, and real or imaginary loss of one or another of the special senses.

In hysterical convulsions the patient usually falls so that he is not hurt by the fall. The eyes seem fixed, but pressure upon the supra-orbital nerve usually brings about reaction.

Nursing.—Such cases are among the hardest that a nurse has to deal with. Tact, kindness, patience, firmness, and infinite resource on her part are most essential. The patient should be kept quiet, yet amused and interested. As a rule, he is not allowed to see many, if any, friends. Therefore the task of providing him with amusement and diversion devolves entirely upon the nurse, and it is a very essential part of the treatment, as it is of primary importance to keep the patient from thinking of himself and of his real or fancied ailments.

Nurses undertaking the care of nervous patients should have some knowledge of massage and hydrotherapy, as they are important factors in the treatment. It must always be remembered that hysteria is as much a disease as typhoid, pneumonia, or any other radical derangement of the functions, and though the convulsions, unconsciousness, etc., are sometimes simulated with the intention of deceiving, this is not usually the case, and such patients usually feel the pain they complain of.

Locomotor Ataxia.—This disease, which is known also as *tabes dorsalis* and *spinal sclerosis*, is due to degeneration of the posterior columns of the spinal cord and posterior nerve-roots. It is characterized by lack of sensation and muscular coördination, defective nutrition, pain, and loss of reflexes, *e.g.*, the

pupils fail to contract when a light is flashed in front of the eyes.

Patients suffering with this disease have a characteristic staggering gait. Normally, once an individual has learned to walk, walking is simply a reflex action, controlled, and to some extent caused, by muscle sense, but the locomotor ataxia patient, having lost this muscle sense, due to degeneration of the nerve fibers over which sensations should pass, must watch every step he takes. If he stands erect with his feet together and eyes closed he staggers and may even fall. When, as is often the case, the arms are affected, he cannot do any work that requires coördination, *e. g.*, writing.

The disease is more common in men than in women and at least three fourths of all cases are due to syphilis. Alcoholism, excesses of any kind, and general debility are contributing factors.

Meningitis.—For meningitis see "Infectious Diseases."

Myelitis.—Myelitis is an inflammation of the substance of the spinal cord. It may be the result of injury, or the sequel of syphilis, of infectious diseases, caries of the spine, or tumors of the cord. It causes a partial or complete paralysis of the legs and bladder and loss of sensation in the lower part of the body.

In caring for a patient suffering with this disease, it must be remembered that there is great danger of bed-sores.

Neuralgia.—Neuralgia is a paroxysmal pain along the course of the nerves. It may be due to neuritis, but there is often no discoverable lesion. The predisposing causes are neurasthenia, a condition of debility following disease, overwork, worry, insufficient

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sleep, lead poisoning, diabetes, nephritis, syphilis, and uterine disease. Attacks are most frequently induced by exposure to wet or cold, and local or reflex irritation of a nerve as, for example, by a decayed tooth. Facial neuralgia, due to a neuritis of the fifth nerve, may be attended with such severe pain that excision of the nerve will be necessary.

Neurasthenia.—The causes of neurasthenia are heredity, overwork, worry, excitement, loss of bodily strength by long illness, and the use in excess of stimulants.

Symptoms.—The principal symptoms are restlessness, insomnia, constant imaginings of pain—which are very real to the patient,—attacks of vertigo and palpitation, fear of disease, or in some cases of crowds or open spaces, an increasing inability to fix the attention upon or to do mental work, and a tendency to hysteria. In many cases there are specific complications, such as anorexia, constipation, indigestion, and migraine.

Nursing.—As in all nervous diseases, everything depends upon the personality of the nurse and on her understanding the physical conditions that control the patient. She must be firm, resourceful, kind, and very determined. It is of the utmost importance for the patient to have his attention diverted from himself; to avoid all fatigue, both mental and bodily; and to do everything to build up the system. Hydrotherapy is now much used for the relief of restlessness and insomnia.

Neuritis.—Neuritis is inflammation of a nerve or nerves. When only one nerve is affected, it is called localized neuritis; when many, multiple neuritis or polyneuritis.

Localized neuritis. Localized neuritis is generally due to either contiguous inflammation, trauma, or stretching of a nerve. It is characterized by intense pain along the course of the affected nerve and hyperesthcsia, followed in severe cases by paresthesia, numbness, and later by loss of sensation and paralysis. The symptoms may abate in a few days, but sometimes they continue for weeks.

Multiple neuritis may be caused by: prolonged exposure to cold; poisoning by alcohol, ether, lead, arsenic, or mercury; infectious diseases—especially sepsis; and other diseases, such as anemia and cancer. The lesions are the same as in localized neuritis, but several nerves in different parts of the body are affected, and constitutional symptoms are more pronounced. The onset is generally abrupt, beginning with a chill and followed by high fever and often by delirium. The worst cases die in one or two weeks from paralysis of the respiratory muscles or of the heart. Other cases continue to grow worse, or remain stationary for a fcw weeks and then recover slowly, sometimes taking a year or more to convalesce. In the longer cases, permanent contractions are frequent.

Neuroma.—Neuroma is a nodular enlargement of a nerve. Some neuromata cause no trouble. Others give rise to pain, anesthesia, paresthesia, or paralysis. Such, when acccssible, are generally excised.

Nursing.—Local applications are of small value. There is therefore little to be done except to keep the patient warm, well nourished, and diverted.

Paralysis.—By paralysis is meant *a loss of motion or sensation in a living part.* It is due to lesions in, or pressure on, the brain, spinal cord, or nerves.

Owing to the decussation of nerves going to and from the brain, in the medulla oblongata, paralysis due to injury or disease of centers in the right side of the brain will show itself in the left side of the body and vice versa.

When only one extremity is paralyzed, the paralysis is known as monoplegia. Paraplegia signifies a loss of power in either both arms or both legs; and hemiplegia, paralysis of one whole side of the body. When there is only a partial loss of power, the condition is known as paresis.

Diphtheritic paralysis is the name given to loss of function in a part on account of poisoning by toxins of the bacillus diphtheria. The muscles of deglutition are the ones most frequently affected.

Occupation neurosis, known also as writer's cramp and occupation paralysis, is due to over use of some of the muscles of the hand, whereby the sensory nerves supplying the part are kept in a state of constant irritation. It is characterized by pain and either lack of control or loss of motion in the affected fingers. It occurs most frequently in neurotic subjects.

Paralysis of children. Two common forms of paralysis that occur in childhood are: (1) Spastic-stiff-paralysis of infants due to rupture of a blood-vessel in the meninges of the brain during birth. The blood-clot causes destruction of the part of the cortex upon which it presses, and, consequently, the muscles supplied with motor nerves which have their origin in that part of the cortex will be paralyzed. (2) Acute anterior poliomyelitis. This form of paralysis was discussed on page 703.

Paralysis agitans (palsy), is characterized by a constant tremor of the muscles.

Nursing.—An easily digested, nourishing diet, plenty of fresh, but not too cold, air, and massage are the main points in the treatment. The more than usual danger of bed-sores due to defective circulation must be remembered and guarded against.

Pott's Disease (Caries of the Spine).—Pott's disease is an osteitis or caries of the vertebra; it may follow trauma or it may occur spontaneously. It is of a tuberculous nature. The pressure upon the cord occasionally causes partial or complete paralysis below the affected point. Almost all "humpbacks" are due to Pott's disease.

Spina Bifida.—Spina bifida is a tumor present, at birth of a child, on its vertebral column, usually over the sacral vertebræ. It is caused by the protrusion of the spinal meninges through an opening in the spinal canal. This tumor is filled with cerebro-spinal fluid.

Tumors.—Both the brain and the spinal cord may be the seat of new tumorous growths, malignant or otherwise. The resulting pressure will cause loss of function in some part of the body, the part depending upon the locality of the tumor.

Diseases of the Respiratory Organs

The Nose—Adenoids.—Adenoids are an hypertrophy of the adenoid tissue. This is a common condition in childhood. If the adenoids are of any considerable size the patient usually keeps his mouth open and thus acquires a stupid expression. There is a tendency to catch cold and to have catarrh. The Eustachian tube is often obstructed and from this ear trouble may result. Adenoids should, if possible,

be removed during early childhood; for, though after puberty the adenoid tissue generally shrinks to its normal size, the ill effects are liable to be permanent.

Hay Fever.—Hay fever is an acute catarrhal condition, with asthmatic breathing, due to some irritant, usually the pollen of a plant. The predisposing causes are a neurotic idiosyncrasy or some nasal abnormality.

Acute Rhinitis (Coryza, Cold in the Head).—Acute rhinitis is an inflammation of the mucous membrane of the nose, accompanied by a watery or muco-purulent discharge.

Chronic Rhinitis (Chronic Nasal Catarrh).—Chronic rhinitis may follow repeated attacks of acute rhinitis, or be the result of disease, severe climatic changes, or the inhalation of irritants such as chemicals or dust.

The Pharynx and Tonsils—Retropharyngeal Abscess.—Retropharyngeal abscess may occur as a primary disease, but it more often follows scarlet fever or some other infectious diseases. The abscess causes an obstruction in the throat, resulting in dysphagia and dyspnea. The chief danger is when the abscess ruptures, as the pus may enter the larynx and cause asphyxia or pneumonia.

Follicular Tonsillitis.—Follicular tonsillitis is an inflammation of the tonsils, due to the streptococci or staphylococci pyogenes. Predisposing causes are former attacks, enlargement of the tonsils, and exposure to cold or wet. Either one or both tonsils may be affected.

Symptoms.—The tonsils are red and swollen and covered, or partly covered, with whitish yellow patches that somewhat resemble the false membrane of diphtheria, but differ in that they are limited to the

tonsils and are not of such a grayish white color. At times, however, diagnosis can only be made after a culture from the patient's throat has been examined and the presence or non-presence of the Klebs-Löffler bacillus ascertained. There are pain in the throat, a high temperature (103° F.), a general malaise, and marked prostration. As a rule, the fever falls by lysis, and the other symptoms abate within a week.

Suppurative Tonsillitis (Quinsy Sore Throat). —Suppurative tonsillitis generally begins as a follicular tonsillitis, but the throat symptoms all rapidly increase. There is intense pain, and the throat is covered with a thick mucus. After a few days an abscess forms, and, unless incised, ruptures, discharging a thick, fetid pus.

Ulcers of the Tonsils.—Syphilis is suspected when there are deep ulcers on both tonsils; carcinoma, when there is an irregular spreading ulcer accompanied by a thin, greenish, fetid discharge.

Nursing.—Astringent and antiseptic gargles or sprays are the main features in the treatment of all diseases of the throat. The local inflammation is much relieved by the application of an ice poultice bound firmly over the tonsil. A strong cathartic is usually ordered, not only to clear out the intestine, but also to act as a counter-irritant and, by exciting a strong peristaltic action of the intestine, draw the blood away from the point of congestion. As the tonsils are directly connected with the cervical lymph glands, any disease attacking them is liable to be associated with comparatively severe constitutional symptoms and a general debility of the system. To counteract this condition as much as possible, a liberal wholesome

diet should be given as soon as the throat symptoms abate.

Some individuals have chronically enlarged, irritated tonsils.

Affections of the lymphatic tissue, known as the tonsils, either acute or chronic, are thought to be largely responsible for the entry into the body of the germs causing rheumatism, endocarditis, and like disorders. For this reason, the frequent use of disinfectant gargles at all times, but, more especially, when there is any irritation or inflammation of the tonsils, is strongly advised by many physicians.

THE LARYNX—ACUTE CATARRHAL LARYNGITIS.—Acute catarrhal laryngitis is a catarrhal inflammation of the larynx due to cold, overuse of the voice, or local irritation.

Symptoms.—There is a tickling sensation in the throat and slight pain. The larynx and vocal cords are red and slightly swollen. The voice is hoarse and in some cases there is aphonia. There may or may not be a slight fever.

Steam inhalations are often prescribed.

CHRONIC CATARRHAL LARYNGITIS.—The symptoms are the same, only less severe, as in acute cases. They are more or less constant.

EDEMA OF THE LARYNX.—Edema of the larynx may occur in connection with any severe inflammatory condition of the throat, or in nephritis.

Symptoms.—A puffy, soft swelling of the larynx, aphonia, and dyspnea may come on very suddenly, resulting, unless preventive measures are immediately taken, in asphyxia and death. Intubation or tracheotomy is often necessary, and when nursing patients afflicted with severe attacks of the disorder, the

proper apparatus should be kept ready for instant use.

Spasmodic Laryngitis (Laryngismus Stridulus, Croup).—Spasmodic laryngitis is a neurotic spasm of the adductors of the vocal cords. The symptoms are alarming but not dangerous. The child generally awakens in the night with a hoarse, croupy cough, dyspnea, and, unless relieved, cyanosis. The attack may last for an hour or two, after which the child will then go to sleep, awakening in the morning perfectly well or with only a slight laryngitis. The attack may be repeated on two or three successive nights.

Treatment.—The treatment consists of steam inhalation, hot compresses to the throat, and cold compresses to the head. A hot bath 105° F. is also sometimes given. Inducing vomiting, by means of an emetic or by tickling the back of the throat with the finger, will abort a spasm.

The Bronchi—Acute Bronchitis.—Acute bronchitis is an acute inflammation of the mucous membrane of the bronchi. It may be caused by the inhalation of irritating gases, by exposure to cold and wet, or it may complicate or follow other diseases.

Symptoms.—There are sore throat, a general malaise, and a constant cough which causes pain in the sternal region. The sputum is scanty at first, but later is abundant and of a viscid, muco-purulent nature. The temperature is generally about 101° or 102° F., but may run as high as 103° F. It generally falls within a week, though the cough and other symptoms may continue for some time longer.

Chronic Bronchitis.—Chronic bronchitis occurs after repeated acute attacks. It is also frequently associated with other chronic diseases, and is a

frequent complaint of the aged. The symptoms are those of acute bronchitis, but much modified.

Nursing.—The cough in bronchitis is frequently very distressing. Poultices are often ordered to relieve it, and hot drinks, especially hot lemonade, are often effective and should be tried. Steam inhalations are frequently prescribed. In bronchitis, as in all lung diseases, it is exceedingly necessary to have a constant supply of fresh air; but the greatest care must be taken to guard against draughts and to keep the patient warm and well covered.

Bronchial Asthma.—Bronchial asthma is characterized by paroxysms of dyspnea, which are supposed to be due to spasm of the muscles of the bronchi. In addition to the dyspnea, there will be cyanosis, vertigo, sweating, a sense of suffocation, and a weak, frequent pulse. Attacks of asthma usually come on at night. True bronchial asthma is the result of inflammation or irritation of the fine bronchi, but asthmatic attacks may be occasioned also by the presence of polypi in the nose, or by defective circulation in the pulmonary blood-vessels, such as may occur as the result of heart or kidney diseases.

When individuals are subject to asthma, an attack is likely to be caused by any disturbance of digestion, excessive fatigue, exposure to cold, the inhalation of irritating substances, anything, in fact, that will harmfully affect the health or irritate the bronchi.

Frequent attacks of asthma are very injurious to the lungs, and various lung diseases, especially emphysema, are likely to follow.

Treatment.—Nitrite of amyl or inhalations of stramonium leaves are often ordered. The patient should be given plenty of fresh air. Hot drinks or

a hot foot-bath will frequently give relief. Change of elimate is often advised.

Emphysema.—Emphysema is generally due to a diseased or weak eondition of the lungs. The air cells become distended and the walls between them broken down. As a natural consequenee, the cells are larger and the number of blood-vessels relatively fewer, and this means a diminished surfaee for the aëration of the blood. Emphysema may also oeeur as the result of injury, especially of wounds of the traehea, or of adenoids or other obstruction whieh constantly interferes with respiration. It is likely to oeeur in those who do a great deal of hard blowing, as glass blowers, horn players, and in those who do hard muscular work under unhygienic eonditions.

Emphysema, if severe, will be probably eomplieated by chronic bronehitis, asthma, and general impairment of the health.

Pleurisy.—Pleurisy is an inflammation of the serous membrane whieh eovers the lungs and lines the thoraeie eavity. It may be either local or general, and either dry or with effusion.

Symptoms.—It may begin with a ehill and fever (101°–103° F.), or the onset may be gradual. There is a short dry eough, severe pain on eoughing or breathing, and rapid, shallow respiration. There is less pain in pleurisy with effusion than with dry pleurisy, the fluid acting as a lubrieant to the inflamed surfaees.

Treatment.—The patient should be kept quiet. A tight binder or strapping of adhesive plaster is often prescribed so as to restrict the breathing and thus lessen the pain. When there is so mueh fluid in the pleural cavity that it interferes with the respiration, aspiration is performed. When the fluid is pus

the condition is known as *empyema* and an operation is performed in order to afford a passage for the draining off of the pus.

Pneumonia.—For pneumonia, see "Infectious Diseases."

Diseases of the Heart

What is Meant by Cardiac Compensation.—Before considering the diseases of the heart it seems well to say a few words concerning the method by which nature endeavors to prevent affections of this organ being as fatal as, without this intervention, they undoubtedly would be. Cardiac tissue being elastic, the heart has the power of dilating to a certain extent, and this it does whenever it is forced to do extra work, as during severe physical exertion or disease, especially when the disease is in part of its own structure. When made to do extra work constantly from either of the above causes the heart remains somewhat enlarged and it also hypertrophies, *i.e.* its muscles become larger and stronger and thus it is enabled to do the extra work thrown upon it. This condition is spoken of as *cardiac compensation;* because, on account of it, the heart is enabled to do its work properly even though there may be some permanent defect in its structure. If the defect is not very severe, the individual may not even know that it exists, but the trouble is that a compensated heart, being already somewhat enlarged, will not, in the future, when extra strain is thrown upon it, be able to enlarge to the same degree as a normal heart, and sudden death or a very serious condition, known as acute heart dilation, which is likely to be fatal,

may follow any great physical exertion, excitement, or disease. When this occurs there is said to be *failure of compensation.*

Angina Pectoris.—Angina pectoris occurs in connection with various heart lesions, such as coronary sclerosis, myocarditis, and aortic insufficiency. The most frequent exciting causes are undue exertion or emotion, severe climatic changes, and indigestion. The condition is characterized by a sudden intense pain in the heart radiating to the left shoulder and down the left arm. The pain is frequently the only symptom, but sometimes there are pallor, cold, clammy sweat, and dyspnea. The pulse is generally accelerated, irregular, and of a high tension, and there is an intense fear of impending death. As a rule, the attack proper lasts only a few seconds or minutes, but it may be days before the patient recovers from its effects.

Acute Simple Endocarditis.—By endocarditis is meant inflammation of the endocardium, the membrane lining the heart. Though no special micro-organisms have as yet been isolated, it is now generally believed that the condition is due to germs which are brought to the heart by the blood, and as it most frequently occurs as a complication or sequela of rheumatic fever and chorea many authorities consider that the same organisms may be responsible for all three diseases and that they enter the body through the tonsils. Others think that as endocarditis so frequently follows any germ disease it may result from invasion by any organism that is capable of entering the blood. As a rule, the whole endocardium is not involved in the inflammatory process, but only very small patohes where the germs are deposited. The

severity of the symptoms will depend upon the virulence of the germs and the location in which they are deposited. Unfortunately, the inflammation usually occurs around one or the other of the valves and the trouble produced is due to interference with their functioning.

Symptoms.—In mild cases subjective symptoms are often absent or so slight that they cause little distress. In more severe attacks there is likely to be an irregular, rapid pulse, palpitation or pain in the heart, and dyspnea.

Prognosis.—Simple endocarditis does not often prove fatal but a chronic trouble with one or other of the valves is likely to occur. With care and proper treatment, however, compensation will occur and unless the valve is badly damaged, the patient may be very little incommoded by the trouble.

MALIGNANT OR ULCERATIVE ENDOCARDITIS.—This form of endocarditis is very likely to complicate sepsis, pneumonia, and gonorrhea. The condition is the same as in simple endocarditis, but the germs causing it are more virulent and, consequently, the infection is so severe that death usually results in from one to eight weeks.

VALVULAR DISEASES OF THE HEART.—The two common forms of valvular trouble are *valvular insufficiency or valvular incompetence* and *valvular stenosis.*

A valve is said to be *insufficient* or *incompetent* when it does not close properly and some of the blood regurgitates or passes backward. This may be due to a dilated condition of the heart muscle in consequence of which the orifices of the affected side are larger than normal, and, as the size of the valves is not increased, their flaps do not come together properly

and there is a leak. This is known as *relative insufficiency*. When the defect is in the valve itself—*e.g.*, when due to endocarditis, its flaps are shrunken, torn, or so stiffened that they fail to close properly—the condition is known as *absolute insufficiency*.

By stenosis of a valve is meant a contraction or narrowing of the valvular orifice in consequence of which the heart must use extra force in order to pump the blood through the opening.

The severity and nature of the symptoms will depend upon (1) the extent of the trouble and (2) which valve is affected.

In young children, it is the mitral valve that is usually affected and in older children and adults it is the tricuspid.

When there is mitral insufficiency, the blood regurgitates from the left ventricle into the left auricle and thus meets, and interferes with, the flow of blood from the lungs. The symptoms of mitral insufficiency will be, therefore, largely due to imperfect pulmonary circulation. Consequently, the patient is likely to be troubled with shortness of breath upon unusual exertion; this may be the only symptom, but he may also cough considerably and be subject to attacks of bronchitis. The pulse is usually rather weak and, if the condition is severe, it may be irregular.

In tricuspid insufficiency, the blood regurgitating from the right ventricle meets and interferes with the flow of blood coming from the venæ cavæ, and consequently the return of the venous blood from all over the body is interfered with. When the condition is severe, the patient will be more or less cyanosed, there will be a chronic congestion in all organs of the body, which will interfere with their functioning, and

edema is likely to occur in various parts of the body.

In aortic insufficiency, the heart, at each beat, must pump into the aorta not only the blood which has come from the left auricle but also that which has leaked back from the aorta since the last beat. However, if the aorta itself is in a normal condition and the mitral valve in normal or fair condition, a *compensated heart* may be able to do its work so well that there will be no subjective symptoms. If, however, the aorta is involved, as when arteriosclerosis exists, the openings to the coronary arteries, which are just near the aortic orifice, are likely to be narrowed and the heart will not receive sufficient blood to allow of its hypertrophying properly and compensation may not take place.

When there is stenosis in a valve, hypertrophy of the side of the heart on which the stricture is will usually occur and subjective symptoms may be slight or absent so long as nothing occurs to cause failure of compensation.

Myocarditis.—This is inflammation of the heart muscle. It is usually associated with endocarditis or pericarditis.

Pericarditis.—By pericarditis is meant inflammation of the pericardium; its causes are the same as those of endocarditis. The chief subjective symptoms are pain, due in some cases to friction between the two layers of pericardium, palpitation, cough, dyspnea, moderate fever.

Pericarditis is always a serious condition, and the prognosis is particularly unfavorable when it is caused by pus-producing organisms and when the heart muscle is much involved.

Palpitation.—This is a rapid and tumultuous ac-

tion of the heart that is perceptible to the patient. It occurs in connection with organic heart disease, and also when there is no heart lesion as the result of reflex irritation—as for instance from flatulent distention of the stomach, from anemia, hysteria, and excitement.

Nursing.—In the care of patients suffering with an acute attack of heart disease one of the most essential things is to keep them in the recumbent position and very quiet. By doing so, the heart will be saved about 21,600 beats a day and consequently will have a better chance to recuperate. Also all excitement, either pleasurable or the reverse, must be avoided and all physical conditions likely to increase the heartbeat; *e. g.*, constipation, indigestion, tympanites. The patient must be well nourished, but only food that will be easily digested can be used (see Chapter XXVI). He must be kept warm, but fresh air is imperative. The treatment must be continued for some weeks after the symptoms have subsided in order to give the heart plenty of time to hypertrophy. In many cases, the nursing the patient receives in a primary acute attack of heart disease will decide whether he is to be a healthy individual or a chronic invalid.

Diseases of the Arteries

Aneurysm.—An ancurysm is a sac-like dilatation occurring on the wall of an artery, due to weakness of the arterial wall. Small aneurysms are very common and occur in many parts of the body; cerebral hemorrhage—apoplexy—for instance is due to rupture of cerebral aneurysm. Large aneurysms, fortunately, are rare for they occur most frequently on the

aorta or its large branches and very often cause death.

The symptoms of an aneurysm will be the presence of a pulsating tumor and the symptoms produced by the pressure of the tumor—what these will be, will of course depend upon its location.

Large aneurysms are very likely to rupture either externally or into a body cavity and cause death within a few minutes, but, in rare instances, recovery follows from the formation of a clot within the aneurysm whereby a solid tumor is formed.

The treatment aims at assisting clot formation. The patient must be kept very quiet and, in order to lessen blood-pressure, on a very restricted diet. Attempts to assist clotting of the blood are sometimes made by inserting fine wire into the sac and passing an electric current through the wire.

Arteriosclerosis.—Arteriosclerosis is an induration, or hardening, of the walls of the arteries. It comes on naturally in all old people; but certain things, such as disease, the overuse of alcoholic stimulants, overeating and consequent formation of poisons due to defective metabolism, sometimes lead to its early development, or to its development to an unusual degree.

Arteriosclerosis will produce all manner of complications. The heart must hypertrophy, in order to be able to force the blood through arteries that have lost their elastic quality, but, though enlarged, it will not be a strong heart, because the circulation in its walls will be defective and its nutrition thus interfered with. This may be the case, in varying degrees, in all the organs of the body, and consequently they will not be able to perform their functions properly.

Diseases of the Veins

Phlebitis.—Phlebitis is inflammation of a vein. It is nearly always associated with thrombosis. It most frequently occurs as a complication of typhoid or other infectious disease, or of varicose veins, the femoral vein being the one most frequently affected.

Nursing.—The extremity is generally elevated and ice-caps applied. It must be kept quiet and never rubbed, as rubbing might dislodge the thrombus. The results of embolism are discussed in Chapter XX, and on page 775.

Varicose Veins.—These are veins that have become enlarged and distended; they occur most frequently in three situations, viz., the superficial veins of the legs, veins of the anus,—hemorrhoids,—and, in men, the veins of the testicle—varicoccle. Varicose veins are due to interference with the venous circulation; common causes of which are pregnancy, abdominal tumors, obesity, and, in the veins of the legs, the wearing of tight round garters and constant standing. Varicose veins of the leg cause pain and swelling and the congestion which results from the hindrance to circulation causes eczema and ulceration. The veins may be ruptured by a slight injury and an alarming hemorrhage result; it can be easily stopped, however, by applying a tight bandage. For description of hemorrhoids see page 786.

Diseases of the Blood, Ductless Glands, and Spleen

Anemia.—This is a condition in which the blood is deficient either in quantity—as after hemorrhage—or in quality. The deficiency in quality may consist in a

diminution of the red blood corpuscles or in a diminution of the amount of hemoglobin, or both.

Anemia is spoken of as secondary anemia and primary anemia. Anemia is said to be secondary when the cause for it is known; *e. g.*, anemia due to hemorrhage, the toxins of disease, high fever, certain drugs, lack of nourishing food.

Secondary anemia may be caused by loss of blood from the body, abnormally rapid destruction of red blood corpuscles, deficiency in the number of corpuscles manufactured in the body, or to the quantity of hemoglobin in the red blood corpuscles.

Secondary anemia will nearly always occur when the temperature is high for any length of time, or in diseases due to germ invasion on account of the rapid destruction of the red blood corpuscles. It will occur after hemorrhage, in badly nourished individuals and those debilitated by disease, overwork, lack of fresh air, et cetera, because of a deficiency in the number of red cells or of the hemoglobin developed in the body. One reason for this deficiency is, that the cells originate in the red bone marrow from cells which have a nucleus,[1] and when the system is in a debilitated condition cell division will not go on as rapidly as in health, or if it does, the cells may be small and contain an insufficient amount of hemoglobin, and in such case, even though the number of red cells is about normal, the patient will be anemic and the ill health attending that condition will be quite as severe as though there was a deficiency in the number of red cells, because it is to the hemoglobin that the red blood corpuscles owe their oxygen-absorption power and the only known function of the red cells is to carry oxygen to the tissues.

[1] The red blood corpuscles in the blood have no nucleus.

Iron though present in the hemoglobin in very small amounts (there is only about 1 part iron to 230 parts red corpuscles) is a very essential constituent of hemoglobin. Therefore, the giving of iron, both inorganic, such as is used in medicine, and organic, obtained from food—see Chapter XXVI,—is a very essential part of the treatment of anemia.

Symptoms.—The symptoms are pallor of the skin and mucous membrane, dyspnea on exertion, indigestion, loss of appetite and strength. Fainting and neuralgia are common, also edema of the ankles, at night, and puffiness of the eyelids.

PRIMARY ANEMIAS.—A primary anemia is one the underlying cause of which is unknown. The diseases coming under this classification are pernicious anemia, chlorosis, leukemia, and Hodgkin's disease.

PERNICIOUS ANEMIA.—The cause of the disease is unknown, but it is thought to be due to some poison that destroys the bone marrow. The symptoms are those of a severe anemia. There is a characteristic lemon-yellow skin, the blood coagulates slowly, and there is a tendency to hemorrhage into the skin and mucous membrane. In severe cases, pus may form around the edges of the teeth. The disease is a very serious one; recovery is exceedingly rare.

CHLOROSIS.—Chlorosis is a form of anemia common to young girls, especially those who are improperly fed, overworked, or subjected to great mental strain. The symptoms are dependent on the extent of blood change. There may be malaise, dyspnea, constipation, cessation of menstruation, and a characteristic greenish-yellow complexion which gives the disease its name.

LEUKEMIA.—Leukemia is a disease of the blood

marked by a large increase of the white blood corpuscles and a decrease in the number of red cells. There are three forms of leukemia: (1) lymphatic, in which the lymphatic glands are enlarged; (2) myelogenic, which involves the bone marrow; (3) splenic, associated with enlargement of the spleen. The spleen may also be enlarged in either of the other varieties.

Pseudoleukemia (Hodgkin's Disease).—In pseudoleukemia the lymph-nodes are enlarged, there is moderate anemia, the skin is sometimes jaundiced or bronzed, and edema is common. The course of the disease is slow, often lasting two or three years or even more. Death, unless caused by intercurrent disease, is generally the result of exhaustion or of pressure by the enlarged nodes on one of the vital centers.

Treatment and Nursing.—Arsenic and iron are two drugs that are very much used in the treatment of anemia. Massage and salt baths are also frequently prescribed. Fresh air, sunlight, rest, nutritious food and that containing iron (see Chapter XXVI) are very important. Another essential is to keep the patient warm, for anemic individuals usually feel the cold intensely.

Purpura.—Purpura is a bleeding into the skin, mucous membrane, serous cavities, or viscera. The exact cause is as yet unknown. There are changes in the blood which cause its coagulation to be retarded and, in some cases, there is a diseased condition of the walls of the blood-vessels. Purpura may follow infectious diseases, diseases of malnutrition, tuberculosis, cancer, anemia, leukemia, rheumatism, and scurvy. It is common in the aged and in nervous conditions.

When the spots under the skin are small, they are called "petechia"; when in streaks, "vibices"; and when in blotches, "ecchymosis." There are several forms of this disease.

HEMOPHILIA.—Hemophilia is strongly hereditary. It is transmitted through the women, who, as a rule, are not themselves bleeders, to their male children. Such children may bleed to death from the slightest scratch. After puberty, the tendency to bleed is somewhat lessened. The cause of the discase is unknown.

Treatment.—Gelatin and calcium salts are frequently used in the treatment of hemophilia, because they assist in the coagulation of blood.

THROMBOSIS AND EMBOLISM.—Thrombosis is clotting of blood in a living blood-vessel. This generally occurs in a vein. Common causes are injury to the vessel by traumatism or disease, or entrance of some foreign matter—as air, bacteria, etc.—into a vein. The result of this clot formation varies. Sometimes the thrombus becomes transformed into fibrous tissue and the channel of the vein is thus obliterated; at other times the clot is slowly absorbed and the channel of the vessel thus re-established; or the clot may become dislodged and be washed into the circulation. It is then known as an embolus.

By embolism is meant the dislodgment of a thrombus and its passage in the blood-vessels. The result of embolism will depend upon where the clot lodges. If it does so in a small blood-vessel that anastomoses with other vessels there will, provided the thrombus is sterile, be no harm done for the blood can pass through the anastomosing vessels; if it lodges in a small end vessel—one which does not anastomose—

the tissue supplied with blood by the vessel will die. An embolus reaching the brain will cause paralysis of the part of the body supplied with nerves from the affected area of the brain, and if this be, as is often the case, one of the vital organs, death will result. A large embolus, *e. g.*, one from the femoral or iliac veins is likely to cause sudden death by entangling itself in the right side of the heart, usually in the pulmonary artery. In such case, the patient generally sits up in bed suddenly with a livid, agonized face, gasping for breath and pressing his hands over the heart region. Death occurs in a few minutes. An infected embolus, even a very small one, will cause trouble, because it will suppurate and be the foundation for an abscess wherever it lodges.

Addison's Disease.—Addison's disease is caused by tubercular or other disease of the adrenals, or suprarenal capsules, and by disease of the abdominal sympathetic ganglia. It frequently follows tuberculosis in other parts of the body.

Symptoms.—The principal symptoms are: a bronze-colored skin, pigmentation of the mucous membranes, attacks of dyspnea, headache, syncope, weak, rapid pulse, lack of mental vigor, apathy, slowness of speech, lack of appetite, and indigestion. The symptoms are not constant at first, but gradually become so. The patient may live for two or three years but the disease is always fatal.

Diseases of the Thyroid Gland

Goiter.—By goiter is meant an enlargement of the thyroid gland. Goitre is rare in this country, but it is particularly common in Switzerland. It is supposed

to be due (1) to the drinking of waters containing a large amount of magnesium limestone,[1] and (2) to infection.

Symptoms.—There is a tumor on one or both sides or in the middle of the neck. The general health is not as a rule, much affected.

Exophthalmic Goiter.—Exophthalmic goiter is known variously as Parry's, Graves's, and Basedow's disease. The thyroid is enlarged, the blood-vessels are dilated, and there is excessive production of thyroid secretion; it is to this latter condition that the constitutional symptoms are due. These are: a rapid pulse, breathlessness on exertion, exophthalmos, *i. e.*, abnormal protrusion of the eyeballs; extreme nervousness; and generally dyspeptic disorders.

Treatment.—The treatment aims at keeping the patient in as good a physical condition as possible and allaying the nervous symptoms. An operation for removal of a portion of the gland is often performed.

Myxedema.—In this disease the condition is exactly the opposite of exophthalmic goiter; viz.; there is, due to disease or absence of the thyroid gland, a lack of thyroid secretion, in consequence of which the patient slowly becomes stupid, drowsy, very fat, the hair falls out, and unless proper treatment is followed he will in a few years be an obese, thick-lipped imbecile.

The special point in the treatment is the administration of thyroid extract obtained from the thyroid gland of an animal.

Cretinism —When the condition known as *myxedema* exists in children it is spoken of as *cretinism* and the children are called *cretins*. The child may be

[1] Such water can be rendered harmless by boiling.

born without the gland or with an imperfectly developed gland, or the gland may be destroyed later as the result of disease. When a child is born without the gland nothing may appear wrong for some time, but suddenly growth, both mental and physical, becomes retarded. A cretin twenty years of age will be about the size of a child of five or seven and will look and be dull and stupid, with hanging mouth, doughy colored skin, and scanty hair. The treatment consists in giving thyroid extract; it will have to be continued for life. If it is, and the child is kept in hygienic surroundings and carefully taught, its physical condition and mental status will be very much improved.

Diseases of the Digestive Organs

The Mouth—Acute Glossitis.—Acute glossitis sometimes follows abrasions of the tongue. It may be due either to infection, or to a general run-down condition of the system. The tongue becomes inflamed and cracked. There is dysphagia, salivation, and, in severe cases, dyspnea, cyanosis, and fever.

Aphthous Stomatitis.—Aphthous stomatitis is more common in young children than in adults. It usually occurs in connection with fevers or other indispositions, especially when the mouth has not been properly cleansed. Small ulcers form on the inner surface of the cheeks and lips, and along the edge of the tongue.

Gangrenous Stomatitis.—Gangrenous stomatitis occasionally follows infectious diseases; or it may be due to the uncleanliness of the mouth, especially where there is a general debility of the system. It

begins as an ulcer, but gangrenous sloughs rapidly develop. There is a high fever, and general septic condition. About 80% of such cases die within a couple of weeks.

Parasitic Stomatitis (Thrush).—Parasitic stomatitis is caused by the *oidium albicans*, yeast fungus. It is seen in poorly nourished babies, when the mouth has not been properly cared for. It may also be the result of dirty nipples, feeding-bottles, etc. It occasionally occurs in adults, when there is a general debility of the system, especially after long illness. A white fungus appears on the tongue, and the mouth is dry and sore. The saliva has an acid reaction.

Ulcerative Stomatitis.—Ulcerative stomatitis is due to certain poisonings, notably lead, mercury, and phosphorus. It is also caused by scurvy and lack of cleanliness. The gums are swollen and red, and they bleed easily. Ulcers form along the edge of the teeth, the teeth loosen, and there is salivation.

Nursing.—Careful cleansing of the mouth before and after each meal is imperative in all the above diseases of that organ (see Chapter VI). In any severe disorder the patient is often fed by nasal gavage, and care must be taken to pass the tube well into the esophagus, so that the liquid will not get into the mouth.

The Stomach—Carcinoma of the Stomach.—The predisposing causes of this trouble are unknown. In addition to the physical symptoms, which are frequently lacking till the disease is far advanced, there is a gradual failure of the general health, pain in the stomach and back, and rapid emaciation, followed by vomiting of undigested food, and, as the disease advances, "coffee-ground" vomitus. After

a test breakfast, the result of the siphonage contains an abundance of lactic and fatty acid, but the HCl is diminished or entirely absent.

Prognosis.—The disease is generally fatal within a year.

Dilatation of the Stomach.—When the stomach is dilated, it cannot contract properly; consequently it does not empty itself completely and the food which remains in it undergoes fermentation so that the patient will be much troubled with flatulence and nausea, and will lose so much food by vomiting that he will become emaciated, anemic, and debilitated.

The special point in the treatment is the regulation of the diet. Five small meals should be taken instead of three of ordinary size; the food must be of a kind that the patient can digest easily and rather dry. When the condition is associated with pyloric obstruction an operation to dilate the pyloric orifice is sometimes performed.

Gastric Neurosis.—Under this heading are included various gastric disorders due to an abnormal condition of the nervous system, there being no lesion in the stomach. Three of the most common forms are:

1. Motor neurosis, in which there is a supermotility of the stomach which causes it to discharge its contents too quickly. There are nervous eructations of gas, and often vomiting, almost immediately after meals and without nausea.

2. Secretory neurosis, which affects the secretory functions of the stomach. In some cases, the percentage of HCl in the gastric juice is increased during digestion; in others, it is diminished; and in still others, there is either an increase or decrease of the total amount of gastric juice.

3. Sensory neurosis. In this, there may be: gastrologia, the pain of which resembles that of gastric ulcer; hyperesthesia, which will cause a sense of fullness and burning in the epigastrium; or nervous anorexia, which often leads to an extreme distaste for food, resulting in emaciation and a general lowering of the body vitality.

ACUTE GASTRITIS.—This is more commonly caused by the ingestion of indigestible food, an excessive quantity of food or some irritating substance. Also it is often present during illness, especially the infectious fevers.

CHRONIC GASTRITIS.—This is most commonly caused by: The constant ingestion of too much food or indigestible food; lack of mastication of food; the use of irritant drugs, spices, and the like; over-indulgence in alcohol, tea, or coffee; other diseases.

Symptoms.—The subjective symptoms vary in different individuals, but those usually present are: Furring of the tongue, fetid odor of the breath, lack of appetite, a feeling of fullness in the stomach, flatulence, constipation, headache, vertigo, attacks of palpitation, nausea, and frequent vomiting.

ULCER OF THE STOMACH.—Gastric ulcers occur most frequently between the ages of fifteen and twenty-five and in anemic individuals, especially those whose occupation entails much stooping. The cause is unknown, but it is thought that superacidity of the gastric juice may be at least partly responsible.

The ulceration consists of a gradual disintegration of a small patch or patches in the wall of the stomach. This disintegration may be in the mucous membrane only, but it may extend into, and even through, the muscle. In the latter case, unless, as sometimes

happens, the diseased portion of the stomach has become adherent to a neighboring organ, the contents of the stomach will pass through the hole into the peritoneal cavity and, unless an immediate operation is performed, the patient will die of peritonitis or hemorrhage.

The special symptoms of gastric ulcer are hyperacidity of the gastric juice, extreme pain in from one to three hours after eating, vomiting, and, in about half the cases of gastric ulcer, there will be frequent hemorrhages and consequent vomiting of blood.

Nursing.—In all disorders of the stomach, the diet is of course of primary importance. In severe cases the patient is generally ordered such liquids as whey, barley water, etc. When he is allowed to have solid food it must be carefully cooked that it may be as digestible as possible. Only such things should be given as the doctor orders. Formerly, in ulcer of the stomach, no food was allowed, but it is now thought that this treatment may increase the bad effects of the hyperacidity and therefore the Lenhartz treatment, or a modification of it, is now very commonly used. For detail see Chapter XXVI.

Acute Appendicitis.—Acute appendicitis is caused by the entrance into the appendix of some pyogenic—pus-producing—germs which there start up an acute inflammation and, unless resolution takes place, the production of pus. Acute appendicitis occurs most frequently in appendices where there is a chronic inflammatory condition. The result of the inflammation will depend upon the virulence of the germs—resolution may take place, as in any other form of inflammation, or pus may be formed. When this happens, if the appendix is not removed, it will

perforate and, if it does this rapidly, the pus will pour into the abdominal cavity and set up a general peritonitis. If, however, the perforation does not occur quickly nor very soon after the onset of the trouble, the inflammation may extend over the walls of the adjacent loops of intestine, which, consequently, will become glued together and form a wall around the appendix that will prevent the escape of pus into the abdominal cavity for a short time.

The symptoms depend very largely upon the virulence of the attack; there is likely to be sudden abdominal pain, which at first may be general, or in any part of the abdomen, but later becomes localized over the appendix; the patient usually lies on the back with the right thigh flexed; other symptoms are, a rising temperature, rapid pulse, leucocytosis, vomiting.

Treatment and Nursing.—When an operation is not performed at once, the patient must be kept very quiet in order to lessen the danger of perforation; the diet is restricted to small quantities of liquids such as albumin water and broths; and an ice-cap is kept over the appendix.

Chronic Appendicitis. — Chronic appendicitis may follow repeated attacks of mild acute appendicitis which cause the walls of the intestine to become thickened and the appendix to become enlarged and, sometimes, adherent to loops of the intestine.

Symptoms.—There may be pain over the appendix, but, frequently, local symptoms are entirely lacking, and gastro-intestinal disorders or severe constipation may be the only signs.

Cholera Infantum.—The most frequent causes of cholera infantum are improper food and feeding,

dirty surroundings, and bad air. It is usually ushered in by some intestinal disturbance. The temperature rises from 103°–105° F., the pulse becomes frequent and feeble, the tongue coated, the mucous membranes dry, the face pallid and shrunken, and the surface of the skin cold. The stools are at first diarrheal, but after a few hours frequent and watery with a musty odor. There are incessant vomiting and colic.

Nursing.—In nursing a patient with this disease, the tendency to collapse must be remembered and guarded against. The child must be kept warm, its food must be carefully prepared and given in small amounts, sometimes only in dram doses, at regular intervals. The diapers should be changed as soon as soiled and put into a disinfectant immediately upon removal.

COLIC.—Colic is due to an accumulation of gas in the stomach and intestines. Pain is relieved on pressure. The most frequent causes are overfeeding or improper feeding, and cold feet. It will often be relieved by the application of hot stupes to the abdomen, and by a purgative. Attention should be paid to the diet.

DIARRHEAS OF CHILDREN.—See "Infectious Diseases."

DYSENTERY.—See Infectious Diseases.

ENTERITIS.—By enteritis is meant an irritated or inflamed condition of the intestine. The common causes of the disorder are: improper food, impure drinking water, anemia, and infectious diseases. There are intestinal colic, tympanites, diarrhea, and nausea. The patient generally lies with the knees drawn up, seeking relief from pain by relaxing the

abdominal muscles. Heat and abdominal pressure will often afford relief.

Nursing.—The usual treatment consists of the application of hot fomentations or a hot-water bag to the abdomen, and the administration of a strong cathartic to rid the intestine of the irritating substance. The cathartic is sometimes followed by a hot rectal injection, or by a few doses of bismuth, if the diarrhea is not checked. Rest in bed, and a boiled milk diet, are usually prescribed. If the condition is neglected, a severe illness may ensue.

Enterocolitis: Ileocolitis.—The inflammation may be situated in either the lower or the upper bowel. When the lesion is in the upper part of the intestine, the stools are of a yellowish-green color and consist of feces mixed with undigested food, some mucus and, perhaps, a little blood. There is abdominal pain which, as a rule, precedes the movement. When the inflammation is in the lower part of the intestine the stools contain more mucus and blood, at times being almost pure blood, and there is severe tenesmus. The temperature is higher and emaciation and prostration greater.

Lessening of the amount of blood and mucus in the stools indicates an improvement in the condition of the intestine. Diarrhea may persist for some time.

Nursing.—The nursing is practically the same as in enteritis. A cathartic, such as castor oil, is generally ordered for the purpose of ridding the intestine of irritating substances; and when this has been effectual, emollient enemata and drugs. Hot fomentations are frequently ordered for relief of the abdominal pain. In giving enemata and irrigations the flow of fluid

must be regulated to enter the intestine very slowly; otherwise, great pain will be excited.

Intestinal Obstruction.—The most common causes of intestinal obstruction are: strangulation of the intestine; strictures, due to cicatricial scars; pressure from new growths; and impaction from feces, gall-stones, etc. In children, intussusception (the telescoping of one part of the intestine into another) may also be a cause.

Symptons.—The symptoms of intestinal obstruction are acute abdominal pain and increasing abdominal distention, constant vomiting of vomitus that gradually assumes a fecal odor, absolute constipation, cold clammy skin, shallow breathing, marked prostration, frequent feeble pulse, and leucocytosis, but no fever.

Nursing.—Keep the patient in bed and give nothing by mouth unless ordered by the doctor. High enemas, with the patient in the knee-chest position, if possible, and rectal irrigation, are generally tried. If these fail, operative measures are resorted to, as otherwise the condition generally proves fatal in a few days.

Hemorrhoids.—Hemorrhoids, or piles, are small blood-tumors which occur near the anal orifice. They are usually due to engorgement of the veins of the rectum; the engorgement is generally the result of constipation, pregnancy, or other condition causing pressure on the blood-vessels of that region. When properly treated before they attain any size, their cure is a comparatively easy matter; otherwise, operative measures are usually necessary. The treatment consists in keeping the bowels well open and topical applications are sometimes ordered. The doctor's orders regarding the cathartics to use should be

carefully followed, as some cathartics may prove injurious.

After operation, cleanliness of the surrounding parts, keeping the patient quiet, and attention to the diet are the chief points to be considered. Milk is never allowed, as it leaves too large a residue to be expelled. In fact, clear broths, or cereal water, in limited amounts, are, as a rule, all that the patient is given until after he has had a movement of the bowels; and opium, or a like drug, is often given to prevent an action of the bowels until the third or fourth day after operation.

The Peritoneum—Ascites.—Ascites is a collection of fluid in the peritoneal cavity. The most frequent causes are: such cardiac, renal, or blood conditions as cause dropsy in other parts of the body, cirrhosis of the liver; portal obstruction; obstruction of the lymphatics; abdominal tumor, and tumors of the peritoneum.

Acute Septic Peritonitis.—Acute septic peritonitis is inflammation of the peritoneum. The most common causes are: perforation in appendicitis, gastric ulcer, and typhoid; rupture of an abscess of the kidneys, liver, ovaries, or tubes; extension of inflammation of any of the abdominal organs; and infected abdominal wounds.

Symptoms.—The usual symptoms are a rise of temperature, frequent, feeble, irregular pulse, rapid respiration, nausea, projectile vomiting of dark, greenish-brown vomitus, hiccough, constipation, tympanites, and in severe cases delirium or stupor. When the peritonitis is due to perforation, these symptoms are preceded by a sudden intense abdominal pain followed by a fall of temperature and accelerated pulse.

Nursing.—The patient must be kept quiet. Frequent sponging and rubbing with alcohol is one of the surest means of obtaining this result. A cradle should be placed under the bedclothes when their weight causes discomfort.

The Liver—Abscess of the Liver.—There are two varieties of abscess of the liver, the amebic and the septic. The former follows, or is associated with, amebic dysentery. It is more prevalent in tropical climates.

In the septic form, the infection may be due to any of the bacilli which promote suppuration. They may reach the liver through the hepatic artery or vein, the portal vein, the gall ducts, from a wound extending to the liver or from a wound of the contiguous organs or tissue. Operative measures are generally resorted to.

Carcinoma of the Liver.—Carcinoma of the liver seldom occurs as a primary growth, but generally follows cancer of some other organ of the body.

Symptoms.—In addition to the physical sign, *i. e.*, the presence of the tumor, the usual symptoms of cancer are cachexic, more or less pain, jaundice, and leucocytosis. The fever is variable.

Cirrhosis.—There are two forms of the disease; in one, the *atrophic*, the liver becomes first enlarged and then abnormally small, in the other, the *hypertrophic*, the liver is permanently enlarged. The atrophic is the usual form of the disease. Its more common causes are syphilis and the overuse of alcohol. The condition is due to injury of the liver cells by the poison of the disease or the drug in consequence of which scar tissue is formed which hardens and contracts. The symptoms which arise are chiefly due

to interference with the portal circulation. Since the blood cannot flow freely through the liver a chronic congestion of the other digestive organs ensues, in consequence of which they cannot function properly. Also, there will be an exudation of serum from the distended blood-vessels into the abdominal cavity, causing the condition known as *ascites*. The passage of bile may be interfered with and jaundice follow. Another very serious result of the disease is that the liver, when in this condition, does not always perform its own function of preparing various toxic substances, brought to it by the blood from the intestine, for elimination, so that a general toxemia may occur. This will result in delirium, coma, and convulsions.

Occasionally, patients suffering from this disease will become fairly well, because a compensatory circulation sufficient to relieve the congestion becomes established in anastomosing vessels.

In the hypertrophic form of the disease the circulation is not interfered with to the extent that it is in the atrophic, but the toxic symptoms are worse, and death usually occurs from the result of the poisoning. This form of the disease is rare and its causes are not understood.

Gall-Bladder and Ducts—Cholecystitis—Cholecystitis is acute inflammation of the gall-bladder. In light cases, there is simply a catarrhal condition of the cystic duct and gall-bladder. In severe cases—suppurative cholecystitis—the cystic duct is almost closed and the bladder is distended with pus.

Symptoms.—In addition to the symptoms of general sepsis, there will be severe vomiting, constipation, and abdominal pain. There is seldom any jaundice. Cholecystitis is very often mistaken for appendicitis.

Cholelithias (Gall-Stones). — Cholelithias is generally due to the entrance of bacteria into the gall-bladder. The cholesterin in the bile and the bile pigment will crystallize around the bacteria or flakes of mucus and thus stones will be formed. The stones may vary in number from a single one to many hundreds. They may be black, white, or any intermediate shade, and they are usually either ovoid or spheroidal in shape. If the stones are very small or remain in the bladder they may do no harm, but if they lodge in the ducts provided for the passage of the bile hepatic colic will result. Some stones may be so large that they will not be able to pass through a duct and will have to be removed by operation, otherwise a serious inflammation and ulceration would follow.

Biliary or Hepatic Colic.—Biliary colic occurs during the passage of a stone from the gall-bladder. During the attack, there is intense paroxysmal abdominal pain, together with nausea and vomiting. As vomiting may relieve the pain, it is often induced. There may be chills and fever. The pulse is generally rapid and weak, and the skin is covered with a cold perspiration.

Treatment.—Individuals subject to hepatic colic are advised to eat sparingly of starches and sugars. During an attack of colic, morphia and hot local applications are used to relieve the pain, and a very important thing for nurses to remember when hot applications are used is that, owing to the intense pain they are suffering, patients may want to have the fomentations or hot-water bag much hotter than they can be used without risk of burning.

Jaundice.—Jaundice is a symptom rather than a

separate disease. The two most frequent causes of this condition are:

1. Obstruction of the bile ducts. This obstruction may be caused by: inflammation of the duct or of the duodenum; impaction of the duct by gall-stones, or other foreign bodies; cancer of the duct or duodenum; or pressure upon the same by tumors of any of the contiguous organs.

2. Toxemic poisoning. This may be due to certain infectious diseases, such as yellow fever, pernicious malaria, and pyemia, or to certain poisons, such as phosphorus, arsenic, mercury, snake-venom, etc. In this case the obstruction takes place in the smaller ducts in the liver and is due to the viscid nature that the bile assumes on account of the large amount of solid substances it contains. The solids consist largely of broken down red blood-cells.

When the discharge of bile from the liver or gall-bladder into the intestine is prevented for any reason, the bile is absorbed by the blood and in protracted cases of jaundice, the blood and all the tissues, with the exception of nervous tissue, contain bile and it is given off in the urine and perspiration, and the skin becomes yellow and the stools clay-colored.

Bile in the blood impairs, in a greater or less extent, its coagulable property. There is, therefore, an increased danger of hemorrhage after injury or operation, when there is any degree of jaundice.

Bile is the great emulsifier of fat. Fat, therefore, should be withheld from the diet when there is jaundice, as there cannot be then sufficient bile in the intestine to digest the fat.

Icterus Neonatorum.—Icterus neonatorum is the name given to the jaundiced condition very fre-

quently present in new-born infants. It appears about the second or third day. In mild cases, the jaundice disappears in a few days. In severe cases, it may be due to congenital stenosis, constriction of the hypatic duct, syphilis, or septic infection of the cord.

The Pancreas—Acute Pancreatitis.—There are two forms of the disease, viz., the hemorrhagic and the suppurative, but the two may occur at the same time. The hemorrhagic form is usually due to gall-stones blocking the common bile duct in consequence of which the bile is retrojected into the pancreatic duct and so into the pancreas. The harm caused by the presence of bile in the pancreas is due to the effect that it has upon one of the digestive ferments secreted by the pancreas—the trypsinogen. Normally this ferment is inactive until it comes in contact with the bile and one of the ferments contained in the intestinal juice, which, ordinarily, it does in the intestine in the presence of food. When, however, the bile enters the pancreas it activates the trypsinogen, and as there is no food for it to digest, and to dilute it, it begins to digest the pancreas itself—consequently, hemorrhages will result.

The suppurative form is due to infection by bacteria. The infection may be secondary to inflammatory affections in neighboring parts, the bacteria may be brought to the organ by the blood, or they may enter the organ with the bile that causes the hemorrhagic disease. In suppurative pancreatitis there may be one large collection of pus or the organ may be studded with small abscesses.

Operation for the removal of the cause and remedy of existing conditions will be the patient's only chance of life.

Chronic Pancreatitis.—This is most often due to a chronic obstruction of the pancreatic duct, to syphilis, alcoholism, or sclerosis of the pancreatic arteries in consequence of which the glandular tissue of the pancreas becomes hardened and atrophied and the gland gradually ceases to perform its functions.

The primary effect of failure of the pancreas to perform its duties is usually a lack of fat digestion. The saliva and the gastric and intestinal juices can digest the carbohydrates and proteids, but the lipase or steapsin of the pancreatic juice is necessary for the splitting of fat. The lack of fat digestion is likely to cause diarrhea and flatulence, and the patient will become weak and emaciated. The other function of the pancreatic juice—the production of an internal secretion which is necessary for the oxidation of glucose in the tissues—may not be interfered with at first, but, as the disease advances, it will and then diabetes mellitus results.

Another form of chronic pancreatitis affects, not the pancreas as a whole, but only certain small areas scattered through its substance, known as the *islands of Langerhans* in which the internal secretion of the pancreas is produced. Diabetes mellitus is the most pronounced symptom of this condition.

Nursing.—As the condition of the stools is generally of diagnostic value in diseases of the pancreas, they must be always carefully inspected when such disorders are suspected and any abnormality reported or the stool saved for the doctor's inspection. The tendency to sudden collapse must be remembered and watched for.

Diseases of the Urinary Tract

The Kidneys—Dropsy (Edema).—Dropsy, or edema, was at one time thought to be a disease, but it is now recognized as a symptom of many of the diseases which affect the kidneys and the circulation. It is characterized by an excess of liquid in one or more of the serous cavities of the body, or in the areolar tissue. It may be either general or local.

General edema is known as *anasarca*.

If the liquid collects in the abdominal cavity, it is called *ascites*.

If the liquid collects in the pleural cavity, it is called *hydrothorax*.

If the liquid collects under the pericardium it is called *hydropericardium*.

Floating Kidney.—Floating kidney is generally due to either: the disappearance of perirenal fat; increased weight of the kidney; congenitally lax peritoneal attachment, with long renal arteries and veins; or tight lacing.

Symptoms.—The symptoms are pain in the lumbar region and mental depression. Neurasthenia, dyspepsia, and abdominal colic are also frequently present. In bad cases, there may be chills and fever and constant vomiting.

Operative measures are frequently required for the relief of this condition, but it can sometimes be remedied by constantly wearing a suitable pad and belt, and attention to the general health in order to increase the amount of fat around the kidney.

Acute Nephritis.—Acute nephritis is an acute inflammation of the kidney. It is due to injury done the kidney cells by poisons which they are endeavoring

to excrete. These poisons may be toxins produced in the body as the result of defective metabolism, or they may be the result of bacterial life in the body either in some distant part, being brought to the kidneys by the blood, or in the kidney substance itself as the result of infection of the kidney. Certain drugs, also, if taken in excess, will injure the kidney cells. Consequently nephritis is a very common complication of scarlet fever, diphtheria, and other acute infectious diseases and skin diseases due to bacterial infection. It sometimes occurs in pregnancy, after extensive burns, or repeated attacks of auto-intoxication due to over-eating, and it will follow the use, in excess, of alcohol, arsenic, carbolic acid, cantharides, iodoform, mineral acids, lead, phosphorus, and mercury.

Symptoms.—The symptoms of acute nephritis vary. Usually the ankles will be swollen and eyelids puffy; there may be headache, pain in the back, nausea, vomiting, dizziness, chills, fever, the urine will be scanty and will contain albumin. When the kidneys are in a healthy condition, the secretory cells in some unknown manner make selection of the matter that is to pass from the blood into the tubules to be excreted in the urine, and such substances as albumin, which are needed by the body, are not allowed to pass, but when the cells are diseased their work is not properly done and injurious substances that should be excreted are often left in the blood, and the albumin is eliminated.

These symptoms may be all present in a very marked degree, or many of them may be lacking or hardly noticeable. They may not appear while the patient is under the nurse's charge but they may come on at any time during the course of, or convalescence

from, one of the infectious diseases, and it is very important that they be recognized at once as there is always more hope of curing the condition if treatment is started at once.

Treatment.—The aim of the treatment in acute nephritis is to lessen the work of the kidneys and to render the urine as dilute as possible, since the toxic substances will be less injurious if their strength is weakened by dilution. To accomplish these objects the bowels and skin are kept active, the former by the use of cathartics, the latter with the aid of hot baths and packs. Food containing a large amount of salts or protein is withheld, as these are the two food elements that are excreted by the kidneys (see Chapter XXVI). In order to dilute the urine, the patient is encouraged to drink a plentiful supply of water. As this is a very important part of the treatment, many physicians require the amount of water given during each twenty-four hours to be charted. The urine, of course, must be measured and the amount charted. Draughts or chilling of the skin are to be guarded against, for this is likely to cause congestion in the kidneys and, if the skin is cold, perspiration will be lessened, which will of course increase the work of the kidneys, for when the skin is active the kidneys are less so and vice versa.

Prognosis.—With proper care the patient may recover in from two to six weeks, the condition may become chronic, or death may occur from uremia, edema of the lungs, or prostration.

Chronic Nephritis.—Chronic nephritis may follow an acute attack of the disease, or the conditions that cause the acute form of the trouble may develop in such a way that the kidney tissue will assume the

characteristics of the chronic forms of the disease from the beginning. Syphilis and the overuse of alcohol are two very common causes of the trouble.

There are two kinds of chronic nephritis: one, called chronic subacute or parenchymatous nephritis, occurs most frequently between the ages of twenty and forty, the other, known as chronic interstitial nephritis or cirrhosis of the kidney, occurs most often between the ages of forty and sixty; it is a common accompaniment of arteriosclerosis and chronic heart disease.

In the subacute form of the disease, many of the renal cells, due to the injury done them by harmful substances that they have been forced to eliminate, are destroyed and replaced by scar tissue, the remaining cells are swollen and full of debris and fat; the kidneys are congested and enlarged. Naturally, a kidney in this condition cannot function properly and, as in the acute form, substances such as albumin, which should remain in the blood for the supply of the tissues, will be excreted in the urine, and the many toxic products of metabolism, which, in health would be excreted, will remain behind to poison the body. Among the substances left behind will be a large proportion of the salts, especially sodium chlorid. This, of course, is not poisonous, but it has a very bad effect if it accumulates in the body, for it passes into the tissues and raises the osmotic pressure in the lymph spaces in consequence of which a much larger amount of serum than is usual will pass from the capillaries into the lymph spaces. This will result in edema.

Symptoms.—The symptoms vary according to the severity of the disease. Many patients, especially in the beginning of the disease, enjoy comparatively good health with occasional exacerbations. Some-

times the symptoms develop very gradually, at other times they will be severe from the beginning. Some patients die in a few months, others live several years. The symptoms to be expected are: Scanty urine of high specific gravity containing albumin and various casts, edema beginning in the face and becoming more or less general; there is always anemia, and sometimes pain in the lumbar region and slight fever; the pulse is incompressible, for the heart and blood-vessels will soon become injured with a condition that both interferes with the circulation and leaves the body full of toxic substances; consequently arteriosclerosis and hypertrophy of the heart will occur. Headache, drowsiness, nausea, dimness of vision, are symptoms that sometimes occur and, when they do, should be reported to the physician since they often portend an attack of uremia.

In the interstitial form of the disease the renal cells have been so largely replaced by scar tissue that the kidneys are contracted and much smaller than they should be.

Symptoms.—The disease and, consequently, the symptoms develop slowly. Since the disease is always associated with arteriosclerosis, the pulse will be very incompressible, there will be gastric disturbances, a gradual loss of strength, and progressive anemia; there is likely to be edema of the feet and ankles, but there is never a general edema as in the parenchymatous form of the disease; dimness of vision from albuminuric retinitis is common. Headache, vertigo, and drowiness often occur; they are always to be regarded with suspicion, since they are the symptoms that nearly always precede an attack of uremia.

Nursing.—The care of the patient is about the same as that necessary in acute nephritis. When nursing patients suffering with nephritis, either acute or chronic, the possibility of the occurrence of uremic convulsions is to be remembered.

Nephrolithiasis (Stone in the Kidney).—How stones come to be formed in the kidneys is not known, but it is thought that the presence of bacteria or other foreign substance may cause some of the mineral matter in solution in the urine to be precipitated. The stones formed from accumulations of this mineral matter are of various shapes and sizes. The effect produced by the presence of stones in the kidney varies; if they are small they may cause little trouble, not even pain, but they may give rise to pyelitis or abscess; they may cause the kidney to atrophy or produce other harmful effects. The stones will pass from the kidney in the urine from time to time. Small ones will give no trouble, large ones will give rise to the excruciating pain known as *renal colic*, which will last from the time the stone gets into the mouth of the ureter until it reaches the bladder. This may be about one hour or several hours. Occasionally, it is necessary for the patient to have a surgical operation for the removal of the stone.

Treatment.—Individuals subject to stone formation are always cautioned to eat sparingly of meat, since meat contains the kind of mineral matter from which stones are formed, and to drink a large quantity of water daily. During an attack of colic, hot baths, hot local applications, hot drinks, and morphine, are usually prescribed.

Pyelitis.—Pyelitis is an inflammation of the mucous-membrane lining of the pelvis of the kidney.

The condition may vary from that of a slight congestion and mild catarrh to necrosis and suppuration. In the latter case, the pelvis of the kidney becomes filled with pus and, in severe cases, the inflammation will extend to the substance of the kidney, and, unless an operation is performed, the pus may be discharged into the perinephritic tissues and adjacent organs.

Symptoms.—In mild catarrhal pyelitis the usual symptoms are pain over the kidney and the passage of turbid urine containing mucous, epithelial, and pus cells. Suppurative pyelitis usually begins in the same way as the milder form, but the symptoms soon increase in severity, and pus will be present in the urine in large amounts except, occasionally, for a day or two, when the ureter of the diseased kidney will be so plugged with pus and other foreign substances that the urine will not be able to pass and all of that voided will be from the sound kidney. There will be also symptoms due to poisoning by the septic material; viz., irregular fever, sweats, chills, and the patient is often dull and apathetic as in typhoid.

Treatment.—An operation is generally performed and about the same treatment and nursing care are required as for nephritis.

Uremia.—Uremia is a toxic condition supposed to be due (1) to retained excrementitious matter that the kidneys have failed to eliminate, and (2) to perverted metabolism, in consequence of which abnormal compounds that act as poisons have been formed. Uremia nearly always occurs as a complication of nephritis. The nature of the poison causing the condition is unknown; formerly it was thought that the poisoning was due to the urea that the kidneys had failed to eliminate—hence the name *uremia*—but it

has been proved that urea by itself is not poisonous. Uremic coma may develop suddenly, but usually there are certain prodromal symptoms, viz., headache, vomiting, drowsiness. It sometimes complicates nephritis and anuria.

Uremia is characterized by headache, vomiting, dyspnea, Cheyne-Stokes respiration, coma, and repeated convulsions. These must be watched for, as they sometimes occur very suddenly. Always keep a clean towel in readiness to put between the patient's teeth. Hot packs are frequently ordered and must be given with care, for patients with uremia are very easily burned. Phlebotomy is usually performed in order to remove some of the poisoned blood and is followed by an intravenous infusion. Croton oil is often ordered; when administering this, it is put into melted butter or glycerin and dropped on the back of the tongue.

The Bladder—Cystitis.—Cystitis is inflammation of the mucous membrane of the urinary bladder. The most common causes are: germ infection, irritation by an excessive or improper use of the catheter, cold, poisoning by cantharides, etc. Cystitis due to germ infection is generally the result of unsterile catheterization. The condition is exceedingly hard to cure. It has a strong tendency to become chronic, in which case it is the cause of endless suffering to the victim. Therefore, too great stress cannot be laid upon the necessity for absolute cleanliness and perfect sterilization of everything used for the operation and of the nurse's hands.

Diseases of the Uterus and Appendages

Exact diagnosis of the various diseases of the uterus and its appendages is made chiefly by vaginal examina-

tion, the symptoms being much the same regardless of the organ affected: viz., pain in the lumbar region and lower part of the abdomen; nervousness; frequently a vaginal discharge, the nature of which assists in diagnosis; menorrhagia, and, if pus is present, more or less marked septic symptoms.

THE UTERUS—ANTEVERSION.—This is a pushing forward of the uterus, a condition generally due to the presence of some mass behind it. The most pronounced symptoms are dysuria and irritability of the bladder.

ANTEFLEXION.—A bending forward of the uterus upon itself. Anteflexion may be congenital or acquired. Dysmenorrhea is an important sign.

ENDOMETRITIS.—Endometritis (from the Greek words, "endo," within, and "metra," uterus, and the termination "itis" meaning inflammation) is an inflammation of the membrane lining the uterus.

LACERATION OF THE CERVIX UTERI.—Laceration of the cervix uteri is a tear of the neck of the uterus. This usually occurs during confinement.

METRITIS (INFLAMMATION OF THE UTERUS).—Septic metritis is most commonly caused by infection during or after labor.

PROLAPSE.—Prolapse is a falling down of the uterus, generally due to loss of tone and relaxation of the uterine ligaments.

RETROFLECTION.—This is a displacement where the uterus is bent back upon itself.

RETROVERSION.—Retroversion is a backward displacement of the uterus. The distinctive symptoms are a feeling of weight and bearing down of the pelvis which is aggravated by standing, menorrhagia, and leucorrhea.

TUMORS.—The uterus and its appendages are frequently the seat of tumors. The nature of these was described on page 619.

THE VAGINA AND PERINEUM—CYSTOCELE.—Cystocele is prolapse or relaxation of the anterior wall of the vagina and consequent hernia.

VAGINITIS.—Vaginitis is inflammation of the vagina. For vaginitis due to gonorrheal infection, see "Infectious Diseases," page 686.

LACERATION OF THE PERINEUM.—Laceration of the perineum is a tear in the perineum. When the tear extends through the sphincter muscle of the rectum, it is known as complete laceration; when it is not so extensive, as partial laceration. The operation performed to rectify this condition is known as perineorrhaphy. For care of patient after this operation see page 514.

ABNORMALITIES ATTENDING MENSTRUATION—AMENORRHEA.—Amenorrhea is absence of menstruation. It is physiological before puberty, after the menopause, and during pregnancy and lactation. The pathological causes are: changes of climate or occupation; psychical disturbances; catching cold; getting the feet wet; sea-bathing or over-exertion during menstruation; such diseases as chlorosis, the infectious fevers, chronic nephritis and diabetes, myxedema, and Addison's disease.

The only symptom may be absence of the discharge; but, if the trouble is long continued, psychical symptoms, such as hysteria, melancholia, and even a species of dementia, may occur at the menstrual period.

Treatment.—The general health must be attended to. Tonics containing iron are generally ordered. Nourishing, easily digested food, fresh air, and as

much exercise as can be indulged in without causing fatigue are all of importance.

MENORRHAGIA.—Menorrhagia is an excessive or prolonged menstruation. Endometritis, displacement, sclerosis of the uterine blood-vessels, tertiary syphilis, malignant disease, tuberculosis, the presence of tumors, etc., are the most common causes.

METRORRHAGIA.—Metrorrhagia is a bleeding from the uterus at frequent irregular intervals; the causes are the same as those of menorrhagia.

DYSMENORRHEA.—Dysmenorrhea is painful menstruation. The symptoms are pain in the pelvis and back and general nervous symptoms during the first twelve to thirty-six hours of the flow. In severe cases, there may be nausea, vomiting, hysterical convulsions, or syncope. The common causes are ill development of the uterine blood-vessels, a narrow cervical canal, obstruction of the cervical canal, anteflexion of the uterus, hyperesthesia of the lining membrane of the uterus, and nervous disorders.

Treatment.—The general health must receive attention, especially the nervous condition. A laxative should be given just before the beginning of the period and the patient kept in bed for the first twelve hours. Local treatment or operative measures are sometimes necessary.

THE FALLOPIAN TUBES—ECTOPIC GESTATION.—Extra-uterine pregnancy is pregnancy which occurs *out of place*. When the impregnated ovum remains in a Fallopian tube, the condition is known as *tubal pregnancy* unless the ovum becomes attached to the portion of the tube situated within the uterine wall when the pregnancy is termed *interstitial*. When the fertilized ovum falls into the abdominal cavity and

develops there the ectopic gestation is spoken of as *abdominal pregnancy*.

Ectopic gestation may be due to constriction, folds, or twists in a Fallopian tube; to pressure upon it by an adjacent organ, or by a tumor; to an abnormally long tube or to impregnation taking place so near the ovarian end of the tube that the ovum becomes too large to pass through the tube before it reaches the uterus.

Occasionally, when the ovum falls into the abdominal cavity it becomes attached to some viscus, the placenta develops, and the fetus goes on to full term and can be removed by abdominal section. More commonly, however, the fetus dies and, usually, unless the condition is recognized and an operation performed, suppurates, thereby producing peritonitis, sepsis, or like trouble. Tubal or interstitial pregnancy cannot continue longer than from one to three months, for unless the condition is recognized and an operation performed, the tube will rupture and, unless operative measures are resorted to, the patient will bleed to death.

Symptoms.—The special symptoms are a slight discharge of blood from the uterus at the time that the menstrual flow should occur and a sharp shooting pain that extends down the lower part of the abdomen and leg on the side of the affected tube. The symptoms of a ruptured tube will be sudden abdominal pain followed by signs of internal hemorrhage.

Treatment.—When ectopic gestation is suspected, the patient is put to bed and must be kept very quiet, for any sudden or great exertion might cause the tube to rupture. When diagnosis is made operation is performed.

HEMATOSALPINX.—Hematosalpinx is hemorrhage into the Fallopian tubes.

HYDROSALPINX.—Hydrosalpinx is a form of tubal inflammation in which there is an accumulation of serous fluid in the tubal canal.

PYOSALPINX.—Pyosalpinx is pus in the Fallopian tubes, due to infectious salpingitis.

SALPINGITIS.—Salpingitis is inflammation of the tubes. It may be either infectious or non-infectious. The latter type may result from cold, injuries, the introduction of irritating substances into the uterus, or tortuosity of the tube. Infectious inflammation is the more common. The gonococci are the most frequent cause of the infection, and next, the streptococci.

THE OVARIES—ABSCESS OF THE OVARY.—Abscess of the ovary is a collection of pus in the ovary.

OÖPHORITIS (OVARITIS).—Oöphoritis is inflammation of the ovary. This is generally due to microbic infection. The most common infection are the streptococci, resulting from puerperal infection, and the gonococci.

Diseases of the Bones

NECROSIS.—By necrosis is meant death of the bone. This usually occurs as the result of injury to the periosteum, in consequence of which the blood supply of the bone is shut off.

OSTEOMYELITIS.—Inflammation of the marrow of the bone. There are tenderness, redness, and swelling over the point of inflammation. There is usually high fever, and there may or may not be chills.

Diseases of the Skin

Acne.—Acne is one of the most common skin diseases. It most frequently appears about the time of puberty, and is apt to run a chronic course until the body is fully developed, after which there is a tendency to recovery. The disease is characterized by small papules, or, in the pustular type, pustules, around the mouth of the sebaceous glands and hair follicles. It is supposed to be due to the clogging of the sebaceous glands by an over-secretion and inspissation of fat. Any form of indigestion or malnutrition is apt to increase the trouble. Therefore, a wholesome, not too rich, easily digested diet, regulation of the bowels, absolute cleanliness, and exercise are of the utmost importance. No local applications ever avail, so long as these essentials are neglected.

Carbuncle.—A carbuncle is a circumscribed inflammation of the skin and deeper tissues due to germ infection. There is a characteristic deep-red hard node that, in a week or ten days, suppurates and discharges pus through several orifices. The treatment is the same as that of any wound.

Eczema.—Eczema is a non-contagious, inflammatory disease of the skin attended with itching, desquamation, and, usually, the exudation of serous or sero-purulent fluid.

Nursing.—It is important in all forms of eczema to keep the skin dry. Many physicians will only allow of the affected parts being cleansed with oils or prescribed ointments. The exclusion of the air is also necessary; this can be obtained by bandaging lint, etc., lightly over the part, or if the head is the seat of the disease, a cap of lint can be made; if the

face, a mask. A mask ean be more casily rctained in place if the lint is cut large enough to eomc well up on the head and under thc ehin and a couple of darts taken on the head and under the ehin. Holes are cut for the eyes, and for the nose, and mouth. *These holes should not be larger than necessary.* The mask ean be either bandaged or tied on.

Epithelioma.—Epithelioma is cancerous growth in the skin.

Erythema.—Thcre are several varieties of crythema. Two of the most eommon are: 1. Erythema hypcremieum. This is a simple reddening of the skin in loealized patehcs due to irritation either internal or external. In some people it is caused by eating some particular food such as fish, etc. 2. Erythema intertrigo. This is an eruption which occurs between two folds of skin in fat people and babies. It should be trcated by keeping the part dry and powdcrcd.

Favus.—Favus is a contagious vegetable parasitic disease that attaeks the scalp and very exceptionally the non-hairy parts of the skin. The usual treatment consists in removing the hair eovering the affected parts and the erusts that form on the sealp and applying some parasitieide sueh as sulphur or mereury.

Furunculosis (Boils).—Furuneulosis is an acute, loealized inflammation oeeurring around the sebaceous glands or hair follieles. The furunculi grow pyramidal in shape, and suppurate, the point of suppuration showing on the surface as a yellow spot. Predisposing eauses are local irritation or impaired health. The aetive cause is the entrance of streptocoeei into the skin.

Herpes.—Herpes is charaeterized by one or more

vesicular eruptions upon reddened bases. Fever blister and cold sore are synonyms.

LUPUS.—Lupus is a chronic tuberculous skin disease.

SCABIES (THE ITCH).—A contagious, animal parasitic disease due to the boring into the epidermis of a minute insect, the *acarus scabiei*. The penetration of this parasite leads to the formation of characteristic burrows and excites the development of a multiform eruption. The burrows are indicated by tortuous (rarely straight), thread-like lines of grayish, sometimes whitish, color which are occasionally mottled with black points. They vary in length from one-eighth to half an inch. The digital spaces, the inner side, and the soles of the feet are the most frequent locations of the infection. The eruption, which itches intensely, especially at night, consists of papules, pustules, and vesicles. The disease is highly contagious, and all clothing, bed-linen, and utensils used by people suffering with it should be disinfected. A common form of treatment is to have the patient take a hot bath and then anoint the skin, twice daily, for three days, with sulphur ointment. At the end of this time the bath is repeated and the bed-linen and underclothing changed. These should not be changed until the treatment is finished.

TRICHOPHYOSIS (RINGWORM).—A contagious disease of the skin due to the infection of the *trichophyton fungus*. It is characterized by the formation of circular scaly patches, and if it occurs on the head, partial loss of hair. The treatment consists in washing the affected parts with soap and water, removing affected hairs, and applying a parasiticide such as sulphur or mercury ointment.

URTICARIA.—Urticaria or hives is an inflammatory

affection characterized by an eruption of pale-red wheels that cause an intense itching, especially at night. Urticaria is usually the result of intestinal disturbances. It is produced in some people by eating certain foods as strawberries and fish.

The treatment consists in avoiding any special cause for the disturbance and during an attack taking saline cathartics and local soda bicarbonate baths.

Nursing in Diseases of the Skin.—Space will not permit of further description of the many diseases and minor disturbances that may affect the skin. There are certain things, however, that nurses should appreciate in regard to all skin diseases; viz.; that many of them are due either to improper diet, over-eating, lack of exercise, uncleanliness, or impaired health in consequence of which the superficial circulation is poor, and there is a lack of tone in the skin tissues that prevents the proper discharge of sebaceous matter from the ducts of the sebaceous glands, causing the latter to become occluded. Such conditions also predispose to the skin diseases caused by microörganisms.

The treatment in skin diseases is such as will ameliorate such conditions. The bowels must be kept active, the diet regulated, exercise taken in the open air, and anything that will irritate the skin, as rough or unclean clothing, avoided. After a bath the patient should be enveloped in a hot sheet or large bath towel and dried by very gently rubbing or patting over the sheet. An irritated skin must never be rubbed.

Diseases of the Ear

Furunculosis.—Furuncles often develop on the surface of the external auditory canal. As in fur-

unculosis on other parts of the body, the cause is infection by pyogenic organisms. The predisposing causes are impaired health and irritation of the membrane covering the canal. This irritation is often the result of endeavoring to remove ear wax with pins and other implements. The furuncles may persist for weeks or even months; the subsidence of one furuncle being followed by the appearance of another. The condition is likely to be attended with considerable pain, temporary deafness, and sometimes a slight rise of temperature.

The usual treatment is irrigation of the ear with hot 112° F. saline solution.

Acute Otitis Media.—This is an acute inflammation of the middle ear, which results in temporary deafness, pain, and more or less fever, 101°–103° F. Otitis media is a frequent complication of the infectious diseases, and of all forms of nasal catarrh. Lack of care of the mouth in illness and improper syringing of the nose are two very common causes of the trouble. The infection may reach the ear through the Eustachian tubes or be carried thither by the blood from distant parts of the body.

The condition is a very serious one and a doctor should be seen, for lack of proper treatment may result in impaired hearing, mastoiditis, abscess of the brain, and other serious complications.

The usual treatment consists in irrigating the ear with hot 112° F. saline solution, and an incision is often made in the drum to permit of the discharge of the pus, it having been found that the wound thus made heals better and with much less permanent injury to the drum membrane than one made by perforation due to the pressure of the pus.

Chronic Suppurative and Non-suppurative Inflammation.—Both these forms, of which there are many varieties, may follow acute otitis media; or they may be the result of adenoids or other abnormal nasal conditions, or of infectious diseases. The amount of the subsequent deafness will depend upon the extent of the inflammation and the presence or non-presence of complications. Attacks of pain, in chronic suppurative inflammation, are a serious symptom. To avoid increasing the condition, it is of the utmost importance that any nasal or pharyngeal disease which may exist be treated, and that anything likely to cause irritation in the ears be avoided. The maintenance of good general health is also exceedingly necessary.

Chronic non-suppurative inflammation of the middle ear is one of the most common causes of deafness. It is usually due to chronic affection of the naso-pharynx and sometimes to lowered general vitality. Attention should be given to it at once, for, if it becomes of long standing, tissue-changes result that are most difficult to benefit. The symptoms are variable; progressive deafness, tinnitus, sense of weight, and fulness in the ear are among the more common.

Mastoiditis.—This is an inflammation in the mastoid cells. It results most frequently as a complication of acute or chronic otitis media. It is a very serious condition and, especially in children, an early recognition is imperative, since in childhood the mastoid bone is so soft that unless an operation is performed to afford drainage of the pus, the latter may perforate through the bone into the brain cavity and cause meningitis or other serious complications.

The primary symptoms are pain and swelling back of and around the ear, and a rise of temperature.

With adults the danger of perforation is not quite so imminent, and unless the symptoms are severe, an operation is not performed at once, but the patient is kept in bed and an ice-cap—which must be kept constantly filled—applied over the swelling. The inflammation may then subside and an operation not be necessary. Should the symptoms increase in severity, it is very important that the surgeon be notified at once.

After operation, the care of the patient is the same as following operation on other parts of the body, but there are certain symptoms that denote cerebral infection that must be watched for. These are: chill, increase in temperature, headache, vomiting, and either delirium or progressive dullness or stupor.

Nursing in Diseases of the Ear.—For methods of irrigating the ear, see Chapter XII. When there is any discharge, care must be taken to cleanse the ear thoroughly. If a plug is used, it should be of absorbent cotton and should be put in loosely, that it may not interfere with the drainage. It must be changed frequently.

A large per cent. of deafness is due to neglect or to improper treatment of minor disorders of the ear, and nurses should discourage the use of unadvised remedies and recommend the consulting of an otologist (ear specialist) for all such aural defects as pain, tinnitus (ringing in the ear), discharge, or deafness.

Diseases of the Eye

The Lids.—The principal diseases of the lids are: 1. Blepharitis—a chronic inflammation of the

margin of the lids. It is caused by uncleanliness, the exanthemata, over-use or strain of the eyes, and exposure to irritating conditions such as dust, wind, or smoke.

2. Chalazion—an enlargement of one of the Meibomian[1] glands due to stoppage of its duct.

3. Ectropion—an eversion of the lid.

4. Entropion—a rolling in of the margin of the lid.

5. Hordeolum—or stye—an acute inflammation which occurs around the follicle of an eyelash.

6. Ptosis—a dropping of the upper lid.

7. Trichiasis—an inversion of the eyelashes which causes them to rub against the cornea.

8. Tumors.—The most common benign tumors which attack the lids are: (*a*) the milium—a yellowish tumor about the size of a pin's head, due to retention in a sebaceous gland; (*b*) the molluscum—a white tumor about the size and shape of a small pea; (*c*) xanthelasma, a small elevation beneath the skin, due to degeneration of the muscle fiber.

The Lachrymal Gland[2] and Ducts.—The principal diseases of the lachrymal glands and ducts are:

1. Acute Dacryocystitis—an abscess of the lachrymal sac.[3]

2. Chronic Dacryocystitis—a chronic inflammation of the lachrymal sac, due to some obstruction in the nasal duct.

[1] A row of small glands bordering the lids, which secrete a thick liquid that prevents the tears from overflowing the lids.

[2] The lachrymal gland is the gland which secretes the tears. It is situated at the outer and upper part of the orbit.

[3] The lachrymal sac is a small sac near the nose which collects the excess moisture discharged from the duct.

3. Epiphora ("Watery Eye").—This may be due to any affection or irritation of the lachrymal ducts or glands.

The Orbit.[1]—The principal diseases of the orbit are:

1. Cellulitis—a suppurative inflammation of the cellular tissue of the orbit.

2. Exophthalmos—a protrusion of the eyeball from the orbit.

3. Periostitis—an inflammation of the orbital periosteum.

The Conjunctiva.[2]—The principal diseases of the conjunctiva are:

1. Acute Catarrhal Conjunctivitis or Pink Eye—an acute catarrhal inflammation of the conjunctiva, accompanied by a muco-purulent discharge. It is due to germ infection and is very contagious, frequently appearing in epidermic form.

2. Chronic Catarrhal Conjunctivitis—a chronic inflammation of the conjunctiva. The discharge is less in quantity and not of as purulent a nature as in the acute form.

3. Croupous Conjunctivitis.—This is characterized by the formation of a membrane on the surface of the conjunctiva. There is no infiltration into the tissues as in the diphtheritic form. The condition is generally due to irritants, chemical, mechanical, or thermic.

4. Diphtheritic Conjunctivitis—an acute inflammation of the conjunctiva associated with exudation, infiltration, and a purulent discharge containing

[1] The orbit is the bony cavity in which the eyeball is situated.

[2] The conjunctiva is the membrane lining the eyelids and covering the front of the eyeball up to the margin of the eyelids.

Löffler bacillus. This is as contagious as any other form of diphtheria and the same precautions against infection must be used.

5. Follicular Conjunctivitis—conjunctivitis associated with "follicles" upon the lower lid.

6. Gonorrheal Ophthalmia—purulent conjunctivitis, due to gonorrheal infection. In caring for such patients it must never be forgotten that the condition is highly infectious.

7. Ophthalmia Neonatorum—a gonorrheal conjunctivitis occurring in the newborn. A very large per cent. of blindness is due to this cause.

8. Pinguicula—a thickening of the connective tissue of the conjunctiva at the inner and outer sides of the cornea.

9. Pterygium—a triangular-shaped vascular prominence of the conjunctiva with its apex extending on to the cornea.

10. Trachoma (or Granular Lids)—a form of conjunctivitis accompanied with hypertrophy of the conjunctiva and the formation of "granules" and subsequent cicatrices. The secretion is contagious and the disease once contracted is very hard to get rid of.

The Cornea.[1]—The principal diseases of the cornea are:

1. Keratitis—an inflammation of the cornea which may be either suppurative, or non-suppurative.

2. Keratoconus—a non-inflammatory conical protrusion of the center of the cornea.

3. Staphyloma—protrusion of the cornea, corneal tissue, and iris, accompanied by inflammation.

[1] The cornea is a transparent membrane in front of the iris.

The Sclera.[1]—The principal diseases of the sclera, are:

1. Episcleritis—an inflammation of the sub-conjunctival connective tissue.

2. Scleritis—an inflammation of the sclera..

3. Staphyloma—a thinning and bulging of the sclera.

The Iris.[2]—The principal disease of the iris is iritis—an inflammation of the iris.

The Uveal Tract.[3]—The principal diseases of the uveal tract are:

1. Panophthalmitis—a purulent inflammation of the entire uveal tract. The eyeball is filled with pus and its functions are completely destroyed.

2. Uveitis—inflammation of the uveal tract.

3. Glaucoma.—Glaucoma is a disease of the eye characterized by increased intraocular tension. There are three varieties: acute inflammatory, chronic, and simple. In the first, there are repeated attacks of inflammation accompanied by severe pain and increasing diminution of vision. The second variety resembles the first, but the attacks are less severe and more gradual in their onset. In the third class an absence of all extreme symptoms is often observed, but there is a gradual increase of intraocular tension resulting in loss of sight.

The Lens.[4]—The principal disease of the lens is

[1] The sclera is a dense, white fibrous membrane which, together with the cornea, forms the outer tunic of the eyeball.

[2] The iris is the curtain hanging in front of the lens, in the center of which is a small hole called the pupil.

[3] The uveal tract is made up of the choroid, the iris, and the ciliary body.

[4] The lens is a transparent body in the center of the eye which directs the focusing of rays of light on the retina.

cataract—an opacity of the crystalline lens or its capsule. Cataracts are known as:

a. Partial, when only part of the lens is involved.

b. Complete, when the whole lens is affected.

c. Stationary, when it does not spread.

d. Progressive, when it gradually increases in size.

Cataracts may be due to:

1. Faulty development—congenital.
2. Old age—senile.
3. General disease.
4. Ocular disease.
5. Traumatism.

THE RETINA.[1]—The principal disease of the retina is retinitis—inflammation of the retina. There are several varieties:

a. Simple retinitis, a simple serous inflammation of the superficial layer of the retina.

b. Albuminuric retinitis, which occurs in connection with nephritis.

c. Diabetic retinitis, which occurs in connection with diabetes.

d. Syphilitic retinitis, which occurs in connection with syphilis.

e. Hemorrhagic retinitis, in which there is hemorrhage into the retina. This is generally associated with disease of the heart or blood-vessels.

f. Purulent retinitis, which is due to the lodgment of septic emboli in the retinal arteries.

THE OPTIC NERVE.—The principal diseases of the optic nerve are:

[1] The retina is a transparent membrane which lines the choroid and contains the nerve endings that receive the impressions of light and color.

1. Hyperemia—congestion of the optic disk. This is most commonly the result of eye-strain from hypermetropia, and astigmatism, over-use of the eyes or working with insufficient, or too strong a light.

2. Optic neuritis—inflammation of the optic nerve. There are two varieties:

1. Papillitic, in which the head of the nerve is affected.

2. Retrobulbar, which affects the nerve fibers behind the eyeball.

Disturbances of the Motility of the eye.[1]—The principal disturbances of the motility of the eye are:

1. Diplopia—a failure of the visual lines of the two eyes to direct toward the same object.

2. Heterophoria—a slight tending of the visual lines away from parallelism, which can generally be corrected by muscular effort.

3. Strabismus (squint) is an advanced heterophoria which the patient cannot overcome.

4. Paralysis—a loss of motion of one or more of the ocular muscles.

5. Paresis—a partial paralysis.

Nursing in Diseases of the Eye.—There is no other organ of the body in which disease will more quickly destroy its function. It is therefore imperative, especially in all suppurative processes, and more particularly in those due to gonorrheal infection, that treatment be started immediately. In such cases a delay of even a few hours may mean the loss of sight. The eye must be carefully irrigated, as

[1] When objects are focused correctly on the macula of the eye, the vision is said to be binocular.

already described in Chapter XII. In cases where there is much pus it may be necessary to do this as often as every twenty or thirty minutes; if pus is allowed to remain long in contact with the eyeball ulceration of the cornea may result. In cleansing the eye great care must be taken not to abrade the cornea; use a soft pledget of absorbent cotton (never gauze) wet in a mild antiseptic solution, and remove very gently all discharge that is not washed out by the irrigation. Never wipe toward the inner angle of the eye or the discharge may be washed into the lachrymal sac and a serious inflammation result. When the lids are so swollen that the eye cannot be properly cleansed, the surgeon generally performs a canthotomy (cutting the outer angle of the eye). This not only allows of the eye being more readily cleansed, but also relieves the pressure on the eyeball. With proper care the resulting wound should heal in a few days.

The method of putting medicine in the eye is described in Chapter XII. Applications are generally best made to the lids with an applicator made by wrapping absorbent cotton around a thin wooden stick. The cotton is moistened in the prescribed solution, the lids everted (as described in Chapter XII), and the moistened swab rubbed over their inner surface. Nitrate of silver, argyrol, and protargol are the germicides most frequently used in acute contagious diseases of the eye. Boric acid 2% is the antiseptic solution most frequently used for irrigation; when bichlorid of mercury is used, it must not be stronger than 1:5000, as a stronger solution would be very irritating to the eye.

Either hot or cold compresses are frequently ordered

especially in the early stages of inflammation. The latter should, however, never be applied without a doctor's order. Heat encourages suppuration; there are therefore many instances in which it is injurious. Cold depresses the circulation, so its use must not be too long continued, and under certain conditions, such as ulceration of the cornea, its use is contra-indicated.

As has already been stated in Chapter XVI, the compresses must be of light material, absorbent cotton being about the best. When there is suppuration, the same compress must never be used twice, and when both eyes are affected, separate compresses should be used for each eye. The compresses should be changed at least every two minutes, and cold ones kept on the ice till required.

When only one eye is affected, or when the inflammation is more virulent in one eye than the other, the well eye is sealed by covering it with a "Buller's shield." One can be improvised with an ordinary watch crystal 1½ inches in diameter, and two pieces of adhesive plaster, one 2½ and the other two inches square, with a hole one inch square in the center of each. The smaller piece of plaster is stuck to the concave side of the crystal, and the larger to its convex surface; being larger this extends beyond the other piece, and when the glass is placed—concave side down—over the eye, the free adhesive portion of this larger piece is fastened to the face above and below the eye and on the nose; it is left free on the temporal side to give ventilation.

As it would not be safe to put glass over the eye of a small child or a very restless patient, something soft but impervious to moisture, so that it will not

absorb any of the diseharge, should be substituted for the glass.

The shield should be removed twiee a day and the eye well washed; a 2 per cent. solution of borie aeid is generally used for this purpose. When the patient is a ehild it is often well to secure its arms before treatment by wrapping it in a sheet.

All dressings used in eontagious diseases of the eye should be burnt immediately after removal; they should be handled as little as possible, and the danger of infeeting one's own eyes eonstantly remembered and guarded against.

The patient's room should be unearpeted and the floor dusted with a damp duster daily but never swept; in the majority of eases the room is kept at least moderately dark.

The patient's general health must receive attention; a light nutritious diet is required, and the bowels should be kept freely open.

CHAPTER XXVI

FOOD

The Nature of Food. Digestion. Infant Feeding. Modification of Milk. Cooking. Serving. Diet in Disease.

THE food we eat being the chief factor in maintaining life, improper food being a predisposing cause of disease, and diet being nowadays more and more considered in the treatment of disease, it is very important that nurses should have some knowledge of the chemical constituents of food, of the action of the different food materials on the body; and of the food suitable to be given under certain conditions and in disease. In a book of this kind it would be impossible to go very thoroughly into the subject, but the following synopsis contains a collection of notes which it is particularly important to remember.

The principal primary elements of food are oxygen, carbon, hydrogen, nitrogen, sulphur, phosphorus, potassium, sodium, calcium, magnesium, and iron. Food is divided into two classes, nitrogenous and non-nitrogenous, according to the amount and combination of these elements. The first class comprises all proteid food; the second, carbohydrates, fats, minerals, and water.

The chief uses of food are: (*a*) to form the body tissues; (*b*) to repair their waste; (*c*) to yield heat,

for the purpose of keeping the body warm and generating energy for the work it has to accomplish.

The heat and energy are developed by the oxidation of the substances resulting from the digestion of food after they have been absorbed and carried to the tissues by the blood. The calorie is the unit used in estimating the amount of heat thus generated. One calorie represents the amount of heat required to raise the temperature of a pound of water 4° F.

Each class of food generates a different degree of heat, thus:

1 gram of protein contains . .	4.	calories
1 " " fat contains . .	9.	"
1 " " carbohydrates contains	4.	"

The amount of each variety of foodstuff required to keep the body in health varies under certain conditions, such as sex, age, mode of life, and climate.

Atwater gives the following standard for a man doing hard labor:

Proteid	Fat	Carbohydrates	Calories
150 grms.	150 grms.	500 grms.	3950

and for a man doing moderate work:

Proteid	Fat	Carbohydrates	Calories
125 grms.	125 grms.	450 grms.	3430

A woman requires four-fifths of a man's rations. A child between the ages of fourteen and sixteen requires nine-tenths of the adult ration, and one-tenth should be subtracted for each two years less of life.

More fat is required in cold countries, and less in tropical, carbohydrate food replacing the fat.

Bulletin No. 28 of the U. S. Dept. of Agriculture (which can be obtained by application to the Secretary of the U. S. Dept. of Agriculture) gives the relative per cent. of the proteins, fats, carbohydrates, and minerals in different foods, and the food value of the more important foodstuffs. There are also several charts and dietary computers on the market which give these quantities in grams. With the aid of these, it is an easy matter to make out properly balanced menus.

Nitrogenous Foods

Nitrogenous foods are the tissue-builders. They make the flesh of the body, they improve the condition of the muscles; they build up and repair the albuminoids of the blood, milk, and other fluids; they also liberate a small amount of energy by oxidation.

Nitrogenous foods consist principally of nitrogen, carbon, oxygen, hydrogen, and sulphur. The principal nitrogenous or protein substances of meat are: myosin, which is the basis of muscle; fibrin, found both in the muscles and blood; and albumin, found in the blood and juices. The nitrogenous constituents of fish are chiefly gelatin and albumin. The proteids of milk are lactalbumin and casein; of the yolk of egg, vitellin; of the white of egg, albumin; of vegetables, legumin and vegetable albumin; and of cereals, gluten.

MEAT.—The value of meat varies greatly with the part of the animal from which it is taken. The parts which have done the most work in life, *e.g.*, the neck and legs, are the toughest, but at the same time the most juicy. Hence they are used for soups and

broths. The parts which have done the least work, *e.g.*, the upper portion of the hind quarter, are the most tender, but the least juicy. They make the best roasts and steaks. The intermediary portions are used for stews and pot roasts.

Meat from young animals is more tender but less nutritious than that from older ones.

Veal, owing to a lack of salts, is lacking in flavor and is not easily digested by some people. When too young—under six weeks—it is very indigestible.

Mutton, being fatter than beef and this fat being largely stearin, is considered by some authorities less digestible than beef.

Lamb contains a large per cent. of fat. Therefore something acid (such as pickles, mint sauce, etc.) is served with it to counteract the effect of the fat.

Pork, owing to a large per cent. of fat, is the least digestible of all meats.

Ham and bacon are much more easily digested than pork, the salting process, used for their preservation, making the fat more easy to digest. In fact, the fat of bacon, when cooked crisp, is one of the most digestible forms of fat.

Fowl, chicken, and pigeon are very easily digested. Ducks and geese are less easily digested, owing to a larger per cent. of fat.

Game is easily digested, but is too highly seasoned for general invalid diet.

Extractives or Meat Bases.—Extractives are so called because they are easily dissolved out of or extracted from the meat. They consist largely of substances called creatin and creatinin, xanthin and hypoxanthin. Their action somewhat resembles that of thein and caffein, the active principles of tea and

coffee. They have little nutritive value, but they are slightly stimulating and give meats their flavor.

Gelatine.—Gelatine is easily oxidized. It contains nitrogen and is therefore classed with the proteins, but it does not contain all the elements necessary for tissue building, its use in the body is the same as that of the fats and carbohydrates. Owing to its mucilaginous nature, it is useful in many disorders of the stomach; but, as it is almost entirely digested in the intestines, its use is counterindicated in disease of the same.

Fish.—Fish contains less nutrient than meat, but is quicker and more easily digested. It is therefore particularly suitable for people whose digestive powers are impaired, and those of sedentary habits. Dark fish contains a larger per cent. of fat than white, and is therefore less easy of digestion.

Eggs.—Eggs contain all the food principles except carbohydrates. Owing to their containing a comparatively large amount of iron, they are particularly valuable in cases of anemia, but the presence of sulphur renders them unfit, in many instances, for persons of weak digestion, because, if absorption from the intestine is delayed, decomposition ensues, and sulphureted hydrogen and ammonia are produced. This is particularly true of the yolk. The white can be used in many cases where the yolk might be productive of serious gastro-enteric disorder.

The decomposition of eggs is due to the entrance of bacteria through their shells. To prevent this, they should be kept in a cool, clean place.

Milk.—Milk is the most easily digested form of proteid food. It contains all the ingredients necessary to maintain life.

In diseases in which much nourishment is not required, sufficient can be obtained from milk; but, owing to the excess of water in its composition, it would have to be taken in too large quantities by those leading an active life. When milk is skimmed, the proportion of fat is, of course, greatly reduced but the protein remains about the same. Casein is the most indigestible constituent of milk. When hard, white curds are present in the stools, it shows that the casein is not being properly digested. It is then often removed by clotting milk with rennet and straining off the whey. The whey contains the lactose, lactalbumin, and salts. Or, sometimes, lime water, barley water, aërated waters, or a peptonizing powder are added to the milk. The first works by rendering the reaction of the milk so intensely alkaline that it is not easily curdled; barley and aërated waters prevent this hard curdling by separating the particles of casein. The peptonizing powder partly predigests the milk.

Non-Nitrogenous Foods

The non-nitrogenous foods are: Carbohydrates, fats, minerals, water.

Carbohydrates.—Carbohydrates consist of carbon, hydrogen, and oxygen. They liberate heat and energy, and, being easily oxidized, they save the tissue from consumption. There are three classes of carbohydrates: amyloses, sucroses, and glucoses. The amyloses include starch, dextrine, cellulose, gums, and glycogen; the sucroses, cane sugar, lactose, and maltose; the glucoses, dextrose and levulose.

Food plants are classified thus: (1) cereals, of which the seeds are used, *e.g.*, rice, wheat, rye, and barley;

(2) legumins or pod plants—peas, beans, and lentils; (3) roots and tubers—potatoes, arrow-root, sago, etc.; (4) green vegetables, *e.g.*, lettuce, spinach, fruit, nuts.

The legumins contain the most protein of any of the vegetables. They also contain a fair amount of starch and are richer in salt than cereals, but a large proportion of cellulose renders them hard for invalids and young children to digest unless they are put through a colander, and, as they contain sulphur, their use in excess will cause flatulence.

Roots and tubers are chiefly valuable for their starch and salts. They also contain sugar, pectine (or vegetable jelly), and vegetable acids.

Green vegetables hold very little nutrient, but are valuable for their salts.

The value of fruit as a food lies in its sugar, free acids, and salts.

Nuts contain a large per cent. of fats. This and a large amount of cellulose render them hard to digest.

SUGAR.—The use of sugar must be limited, for it is very rapidly absorbed, and an excess causes an overloading of the system that may result in indigestion or derangement of the excretory organs. Cane sugar, especially, delays digestion and is irritating to the mucous membrane. Used in small quantities, however, sugar may take the place, weight for weight, of starch, as a generator of heat and muscular force; and as it is more quickly digested, it is to be preferred during unusually hard work. Its action is, however, more effervescent. Sugar is very valuable in tropical countries, where fat cannot be taken in any quantity.

Sugar is changed by the gastric juice into glucose and lactic acid. In disease, when absorption is retarded, sugar should only be taken in very limited

quantities, since it is likely, if not quickly absorbed, to ferment and cause flatulence.

Fat.—Fat is the chief fuel ingredient of food, a pound of fat being more than the equivalent of two pounds of proteid or carbohydrate. It forms fatty tissue, but not muscular. The amount of fat required in the diet depends upon the amount of heat and energy required. Thus people in cold countries and those who do hard labor will utilize a larger amount of fat than people living in warm climates or those doing work that does not require the output of a large amount of energy.

Minerals.—When food is burnt, a varying amount of ash is left behind; this is the mineral matter or salts. These salts are very necessary for the well being of the body, since salts enter largely into the composition of all muscular and osseous tissue and are a very important constituent of the blood and other liquids. A lack of lime salts may result in rickets and malformation of the bones. A lack of iron may impoverish the hemoglobin of the red blood corpuscles, on which depends their power of carrying oxygen to the tissues, and this impoverishment may cause anemia or other disorder of deficient oxidation. A lack of potash salts predisposes to scurvy, and a diminished supply of sodium chlorid interferes with the process of digestion by changing the reaction and density of the gastric secretions.

These salts leave the body in large quantities in the excreta, and this daily loss must be made good by the food. When a deficiency of any one salt is obvious, food containing a large amount of the same should be given. Thus foods rich in iron, as eggs, beef, spinach, lettuce, raisins, and oatmeal, should be

furnished in anemia; potatoes in scurvy, because potatoes are rich in salts of potash; and similarly green vegetables and fruit are beneficial in the majority of blood diseases.

WATER.—A certain amount of water is necessary to proper digestion and metabolism. It acts as a solvent for food and accelerates tissue change. People who do not drink sufficient water are liable to have an accumulation of waste products continually in the system. The amount of water taken under ordinary circumstances, counting that of both solid and liquid food, averages about four pints daily, while the average amount removed from the body by the kidneys, bowels, skin, and lungs, averages about four and one-half pints. The excess is formed within the system during the process of oxidation.

Spices and Condiments

Spices and condiments are very necessary food adjuncts. By their action on the mucous membrane of the stomach and on the organs of taste and smell, they stimulate the secretion of gastric juice, and by improving the flavor, increase the appetite. Excessive use of condiments causes indigestion by over-irritation and stimulation of the secretory organs of the stomach.

The addition of sodium chlorid is of particular importance, as it is from it that the stomach manufactures hydrochloric acid.

Flavoring extracts are volatile oils. They must therefore be kept tightly corked and, when possible, be added only at the completion of cooking.

Beverages

Cocoa and Chocolate.—Cocoa and chocolate, unlike coffee and tea, have a decided food value. Though stimulants, owing to the presence of theobromine, they are less apt to induce nervous symptoms than tea and coffee; but a large proportion of fat (cocoa contains about 28%, chocolate, 48–50%) renders them unsuitable for people with weak digestions. They are both made from the seeds of the cacao bean. Chocolate is prepared by adding starch, sugar, and a flavoring extract to cocoa.

Coffee.—Coffee has a stimulant effect upon the system owing to the presence of caffein. It contains caffeic acid, an astringent substance that is similar to tannin and, if allowed to stand too long on the grounds, or if taken in excess, it will cause indigestion by interfering with the secretion of gastric juice and it may occasion insomnia and nervousness.

Tea.—Tea is made from a plant which grows chiefly in China, Japan, and India. There are two classes, black and green. There are many varieties of both black and green tea, all of which are obtained from the same plant, the finer and better teas being made from the small leaves and the coarser teas from the large ones. Black teas are fermented before drying, and green teas are not. As fermentation makes tannin less soluble, an infusion of black tea will contain less tannin than one of green.

Tea, owing to its active principle, thein, is stimulating and refreshing, and by reason of the astringent action of the tannin on the tissues of the digestive organs it retards waste and digestion. It is therefore, when properly made, good for old people and

for persons doing hard work, but it is bad for young children and for persons with weak digestion or nerves. As it retards digestion, tea should not be taken with, or soon after, a heavy meal.

The Digestion of Food

All food must undergo certain changes before it is ready for assimilation. This preparation is known as digestion. The changes that occur in foodstuffs from the time they are absorbed until they are eliminated in the excretion are termed *metabolism.*

There are two processes of digestion, mechanical and chemical. The former consists of mastication, swallowing, the churning motion of the stomach, the peristaltic action of the intestine, defecation.

Chemical digestion is due to the enzymes or ferments contained in the digestive juices of the body. The action of these ferments on the different foodstuffs is shown in the following table:

Fluid.	*Ferment.*	*Action.*
Saliva	Ptyalin	Turns starch to sugar.
Gastric juice	Rennet	Solidifies fluid milk.
	Pepsin	Turns proteins into proteoses and peptones.
Pancreatic juice	Amylopsin	Like pytalin.
	Trypsin	Continues the work of the pepsin, and changes the proteoses into peptones and the peptones into amino-acids and other simpler substances.
	Lipase or Steapsin	Decomposes fats.
Intestinal juice	Invertine	Inverts sucroses.
	Erepsin	Like pepsin and trypsin.
Bile		Bile emulsifies fats, furthers their absorption, and lubricates the intestinal walls.

The reaction of the saliva and pancreatic juice is alkaline; that of the gastric juice, acid. This acidity is due to the presence of hydrochloric acid, which is manufactured by the stomach from sodium chlorid taken from the blood.

Babies under eight months have very little ptyalin in their saliva; therefore starch must never be given them unless fully dextrinized.

To test for starch. Pour a little tincture of iodine on the substance to be tested; if the tincture turns blue, starch is present.

When the functions of the digestive organs are impaired, it is often necessary to predigest the food before it is eaten—*i.e.*, to cause changes in it similar to those caused by the digestive ferments. These changes are obtained by heat and by prepared ferments which have the same action as those of the digestive juice. Thus the casein of milk is coagulated by the action of rennet, a ferment obtained from the stomach of calves; milk is peptonized by the use of pancreatin; cereals are dextrinized by the use of long-continued heat, by ferment, etc.

In using ferments, it is imperative to follow implicitly the directions given for their use. They will only act at certain temperatures; and if their action is not arrested at the right time (by raising the temperature of the food or by putting it on ice), the food will become too fully digested and so be rendered unfit for use.

Absorption of Food.—The absorption of food takes place mainly in the small intestines. As only food that is absorbed is of nutritive value to the body, its worth is estimated by the thoroughness with which it can be prepared for absorption. The follow-

ing table, taken from Bulletin No. 142 U. S. Dept. Agriculture, shows the average degree of the absorbability of the different foodstuffs.

	Protein	Fat	Carbohydrates
Meat and fish	97%	95%	98%
Eggs	97%	95%	98%
Dairy products	97%	95%	98%
Mixed diet:			
Animal food	97%	95%	98%
Cereals	85%	90%	98%
Legumes (dried)	78%	90%	97%
Sugar			98%
Starches			98%
Vegetables	83%	90%	95%
Vegetable foods in mixed diet	84%	90%	95%
Fruits	85%	90%	90%
Total food of mixed diet	92%	95%	97%

Rules Governing the Cooking of Food

Many of the nutrient and digestible qualities of food are lost by improper cooking. In illness, both the digestion and absorption of food are liable to be retarded and imperfect. It is therefore very important, first, to avoid all possible loss of the nutrient constituents of any food, that the required amount of nourishment may be given in little bulk; and, secondly, to do everything to render it as nearly as possible ready for assimilation, that the digestive organs may be spared all unnecessary labor.

Facts Regarding the Action of Heat, etc.—To fulfil these requirements it is necessary to remember the following facts regarding the action of heat, acids, alkalies, etc., on the more common foodstuffs.

1. Albumin. Albumin is coagulated by heat (150°–170° F.), alcohol, and mineral acids. It is soluble in vegetable acids and cold water.

2. Casein. Casein is coagulated by all acids, by rennet, and, to a slight extent, by heat.

3. Legumin. Legumin is coagulated and hardened by salt.

4. Starch. Starch is dextrinized by heat and certain ferments. It is soluble in water.

5. Sugar is inverted into glucose by heat and acids. Glucose is only half as sweet as sugar.

Practical Application of Facts Regarding the Action of Heat, etc.—1. Albumin and proteins of a like nature are coagulated by heat, alcohol, and mineral acids. Albumin is soluble in cold water.

(*a*) Milk. If milk is heated above 170° F., the lactalbumin (the most easily digested proteid substance of the milk) coagulates and forms in a scum on top of the milk. Much of the natural salts of the milk are collected in the scum and are thus also lost. It is the loss of these salts that renders sterilized and improperly Pasteurized milk objectionable for infant feeding. (*b*) Eggs. Egg albumin coagulates at a temperature of from 138° to 170° F. If the heat exceeds this to any great extent, the albumin is hardened and so rendered indigestible. Therefore, cook eggs slowly, do not boil them. (*c*) If meat is exposed to a high degree of heat for a few minutes, the albumin will coagulate and form a crust which will keep in the extractives, but, if the high degree of heat is maintained too long, the albumin will be hardened and the meat rendered tough. Therefore, in boiling or roasting meat, expose it to a high degree of heat for a few minutes—eight to ten—to prevent the loss of extrac-

tives and consequent loss of flavor, and then lower the temperature to prevent the meat from becoming tough. In making stews or soups, do not allow the heat to exceed 180° F., or the coagulation of the albumin will prevent the escape of the juice which is wanted in the soup and gravy of the stew. (*d*) Put cereals and vegetables into boiling salted water while it boils, that the proteid may be coagulated and that consequent loss of it and of the salts may be prevented. As a further preventive, it is better to cook potatoes before peeling them. (*e*) Be careful when adding alcohol to eggs and milk or they will curdle. (*f*) Never let meat stand in water unless you wish to draw out the extractives, as in soups and stews. To wash meat, rub with a damp towel.

2. Casein is coagulated by acids and rennet.

Casein of milk is not always easily digested. The casein can be coagulated by the addition of acids or rennet, preferably the latter, and the whey strained from it. The whey contains the lactalbumin, lactose, salts, and water. It is necessary to remove the fat by skimming before putting in the rennet, as it interferes with the curdling of the casein.

3. Legumin is coagulated by salt.

When cooking peas, beans, and lentils, do not put salt into the water until they are soft. If the water is hard, add a little bicarbonate of soda. The reason for this was given on page 104.

4. Starch is dextrinized by heat and by ferments. It is soluble in water.

(*a*) Do not cook potatoes, which are rich in starch, too long or they will be waxy, owing to the conversion of the starch to dextrine. (*b*) Cereals should be partially dextrinized before being eaten. Therefore

they should be cooked for a long time, especially for children, or the cooking should be replaced by the addition of some dextrinizing ferment, such as diastase of malt. (*c*) Do not soak new vegetables in water, or there will be a loss of starch and salts. Old vegetables, having lost their water, will not lose their starch until a certain amount of water has been absorbed, and they are improved by soaking for from one to one and a half hours.

5. Sugar is inverted into glucose by heat. Glucose is only about half as sweet as sugar.

As glucose is only about half as sweet as sugar, the sugar is wasted if it is added to mixtures before they have nearly finished cooking. Of course, in many instances—as in baked puddings—this cannot be helped, but when possible add sugar only shortly before removing the substances from the stove.

Effect of Cooking.—1. Meat. Its connective tissue is softened, its flavor is improved, and the meat is rendered more palatable by the coagulation of the blood, etc.; albumin is hardened; germs are killed; and the nutriment is rendered more concentrated, by the loss of a certain per cent. of water. A certain amount of fat and extractives are also lost, but a too great loss of the latter will be prevented by proper cooking.

2. Vegetables and cereals. The cellulose envelopes surrounding the starch granules are softened and ruptured and the starch granules swell, forming, if properly cooked, a mealy paste. Cellulose in its natural state is too hard to be acted upon properly by the digestive organs of the body.

Infant Feeding

There is nothing of greater importance in the care of an infant than its feeding. In infancy and childhood, food is required not only to supply nutrient, warmth, energy, and to replace tissue waste, but also to build new tissue. Also, at no other stage of life is food more apt to be the cause of disease; some reasons for this are that during the first few months of life the ferments of the digestive juices are not manufactured in the same proportion as in later life, the mechanical action of the stomach and intestines is feeble, and the mucous membrane lining the alimentary canal is exceedingly delicate and easily irritated.

Statistics show that babies nursed by their mothers are not only less liable to the diseases of malnutrition during their infancy but are less subject to the so-called "diseases of childhood," and have greater powers of resistance in any illness. This being the case, when necessary to resort to artificial feeding a food must be sought that will as nearly as possible resemble human milk. Good cow's milk will answer the requirements better than any other food after certain changes have been made in it. These changes are to rectify the difference in the average proportion of the constituents of cow's and human milk. This difference can be seen in the following table:

Human Milk		"Certified Cow's Milk"[1]	
Fat	4.00%	Fat	4.00%
Sugar	7.00%	Sugar	4.30%
Protein	1.50%	Protein	4.00%
Salts	.20%	Salts	.70%
Water	87.00%	Water	84.00%

[1] Cow's milk varies considerably in the relative quantity of its constituents, especially in the proportion of fat. Certified

Other important differences between the two milks are: (1) The proteid of human milk is two-thirds lactalbumin and one-third caseinogen, while cow's milk is five-sixths caseinogen and one-sixth lactalbumin. (2) Human milk coagulates in small flocculent curds and cow's milk in firm masses. This difference in curding is chiefly due to the difference in the proportion of caseinogen and lactalbumin and to the difference in the reaction of the milk, human milk being much more decidedly alkaline than cow's milk and therefore less easily curded by the acid gastric juice.

To make cow's milk more nearly resemble human milk—*i. e.*, to keep the comparative proportion of fat[1] about the same, to decrease the proteid, increase the carbohydrate, the following method is adopted: The milk, while fresh, is put into sterile quart bottles and allowed to stand until the cream has risen to the top. A certain number of ounces of cream,[1] or, as it

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milk, *i. e.*, milk inspected according to law, calls for the above amount of fat and for not more than 40,000 non-pathogenic bacteria to the c.c. When possible certified milk should be used in the preparation of infant food.

[1] The number of ounces of cream necessary to remove in order to obtain certain per cents. of fat can be seen by the following table:

Top	2	oz.	mixed	24	%	Fat	Top	14	oz.	mixed	7.8	%	Fat
"	3	"	"	22.5	"	"	"	16	"	"	7.0	"	"
"	4	"	"	21.4	"	"	"	18	"	"	6.3	"	"
"	5	"	"	19.2	"	"	"	20	"	"	5.8	"	"
"	6	"	"	17.8	"	"	"	22	"	"	5.4	"	"
"	7	"	"	16.0	"	"	"	24	"	"	5.0	"	"
"	8	"	"	13.3	"	"	"	26	"	"	4.7	"	"
"	9	"	"	11.5	"	"	"	28	"	"	4.5	"	"
"	10	"	"	10.0	"	"	"	30	"	"	4.3	"	"
"	12	"	"	9.0	"	"	"	All mixed			4.0	"	"

is more properly called, top-milk, are then removed, the number depending on the comparative proportion of fat to protein required; thus, if a milk one part proteid to three of fat is wanted, a ten per cent. milk will be necessary, and to obtain that the upper ten ounces of cream are skimmed off; while if a milk one part proteid to two of fat is required a seven per cent. milk is needed and the upper sixteen ounces should be removed. The top-milk is then well stirred and as many ounces of it as the prescription calls for measured off. This is sufficiently diluted with sterile or cereal water to give the required per cent. of fat. The deficiency in carbohydrate is made up by adding lactose-sugar of milk—in the proportion of one ounce of sugar to twenty ounces of milk mixture. In emergency, cane sugar can be used instead of lactose, but owing to its sweeter taste and liability to ferment in the stomach only about half the quantity of lactose is taken. Lime water, about one ounce to twenty of milk mixture, was formerly often added to make the milk more alkaline and so prevent its forming a hard curd. Cereal water is now much used as a diluent, because it adds to the nutritive value of the food and helps to prevent the caseinogen forming in a hard curd, but it was found that this resulted in the milk being digested in the intestine, since the enzymes of the gastric juice will work only in an acid medium, and delayed the development of the gastric glands; therefore, lime water is now added only when necessary. Cereal used for such a purpose must be very thoroughly cooked, in order to predigest it, for, otherwise, infants having no ptyalin in their saliva, will be unable to digest it.

During the months of lactation, human milk under-

goes a slow but continual change; therefore, in regulating an infant's feeding, its age must be taken into consideration. The following table shows, approximately, the quantity of the various food principles required at various ages:

	Fat %	Sugar %	Protein %	To make, take: Milk Sugar	Lime Water	Milk		Sterile water q. s. to make
3–7 days	2.0	6.0	0.60	1 oz.	1 oz.	4 oz.	10%	20 oz.
1–4 weeks	2.5	6.0	0.70	" "	" "	5 "	" "	" "
1–3 months	3.0	6.0	1.00	" "	" "	6 "	" "	" "
3–4 "	3.5	6.0	1.25	" "	" "	7 "	" "	" "
4–6 "	4.0	6.0	1.50	" "	" "	8 "	" "	" "
6–9 "	4.0	7.0	2.00	¾ "	" "	11 "	7 "	" "
9–12 "	3.0	6.5	2.50	½ "	" "	15 "	4 "	" "

The child's age, however, is not an infallible guide in regulating its feedings. If a child loses or does not gain in weight, if it vomits, has colic, or if its stools are abnormal, the probabilities are that it is not getting the food principles in right proportion. A loss of, or failure to gain in, weight, often indicates a deficiency of sugar in the diet. Colic, green, watery, acid stools, an excess of sugar, vomiting, diarrhea, and small lumps of fat in the stools are often the result of too much fat; while constipation is often an indication of too little fat; and hard curds in the stools, colic, and vomiting are frequently due to an excessive quantity of proteid.

Another common cause of digestive disturbances in infancy is overfeeding. The capacity of a baby's stomach during the first twelve months of its life can be seen by the following table.

Third to seventh day . . .	1 –1½ oz.
Second to third week . . .	1½–2½ "
Fourth to fifth week . . .	2½–3 "
Sixth week to third month . .	3 –4½ "
Third month to fifth month . .	4 –5½ "
Fifth month to ninth month . .	5½–7 "
Ninth month to twelfth month .	7½–9 "

To Prepare the Milk.—Obtain the top-milk. This is usually done in either of two ways. (1) By skimming—take off the first ounce with a teaspoon and the remainder with a Chapin dipper. While skimming hold the dipper immediately below the cream level, never put it deeply into the milk. (2) By siphonage—attach a piece of rubber tubing, in size a little longer than the bottle, to a small funnel, put the tubing into the bottle with its end touching the bottom of the latter. Start siphonage by pouring about one ounce of milk into the funnel and, before it has all run through, inverting the funnel over a graduated measure. When a sufficient number of ounces have been removed to leave the required quantity of top-milk in the bottle, withdraw the tubing. Mix the top-milk thoroughly. Next, dissolve the milk-sugar in some of the sterile or cereal water, then add the top-milk and next the water. Stir the milk mixture, and pour the quantity required for each feeding into a separate bottle, using a funnel. Plug the bottles with sterile, non-absorbent cotton and, unless the milk is Pasteurized, put them immediately in the ice-box.

Chapin Milk Dipper

To Pasteurize the milk, when no regular apparatus is to be had: Place the bottles in a wire or some other kind of basket, and put this in a saucepan of cold water with a towel or a piece of wood underneath it. Bring the water up to such a temperature that the milk in the bottles shall be raised to 165°. Keep the milk at that temperature for thirty minutes.

Cool the milk rapidly by putting the bottles in lukewarm running water and reducing the temperature of this with ice, as quickly as possible without breaking the bottles. Keep it in the refrigerator. Warm the milk to 100° F., by putting the bottle in warm water before giving it to the child. See that he gets it, and takes it, while it is warm.

When preparing milk for infants there are three very essential things to remember, *viz.:* (1) To keep it cold so that any germs which may be therein will not increase in number or become active. (2) To keep it clean. (3) To be accurate in measuring.

In order to keep the milk cold, it should not be kept out of the ice-box longer than necessary; when there are several prescriptions to be filled the entire supply of milk must not be taken at once, but, rather, a bottle or two at a time as they are required.

To keep the milk clean, the utensils and milk bottles should be absolutely clean and sterile, the worker's hands scrubbed and disinfected before beginning work, and a clean apron, that will completely cover the uniform, put on. It must never be forgotten that there is no substance in which germs will thrive more readily than milk, and nothing more productive of disease in infants than germ-laden milk.

Care of Bottles and Nipples.—After milk bottles have been used, rinse them immediately in

cold water, and wash in soda or borax and hot water, using a bottle brush. Rinse the nipples in cold water, put them on the fingers, and scrub with soap and water. Then turn them inside out, and scrub the inside parts in like manner. The rest of the treatment of the nipples differs in different institutions.

The following are the most common methods of procedure:

1. Have an individual nipple for each child, and keep, when not in use, in a mug of boric acid.

2. After use, boil each nipple for three minutes in salt solution.

3. Have a sufficient number of nipples to last twelve hours, dry them after washing, and keep them in a clean jar. Boil them all at the same time and either put them into a jar of boric acid, or dry them with sterile towel and keep in a dry, sterile, air-tight jar.

To determine whether the hole in the nipple is the proper size, hold the bottle upside down. If the nipple is in good order, the milk flows through, drop by drop. If the hole is too small, make it larger by puncturing with a sewing needle which has been heated until the point is red. Never use a nipple in which the hole is too large.

The Feeding of Children

The necessity for careful feeding does not end with infancy; much of the disease and suffering in adult life can be traced to errors of feeding in childhood. Many foods that are quite easily digested by healthy adults will prove injurious to children. Also, the method of feeding children requires to be different from that of adults. As has been already stated, during infancy and childhood, food is required not only

for the nourishment and repair of tissue and for fuel, but also for the formation and development of new tissue; children, therefore, require comparatively more food than adults, but as their stomachs are smaller, it must be given them in smaller amounts at a time; and, consequently, more frequently. This does not mean that children should be allowed to eat whenever they wish,—far from it; children should not be allowed to eat between meals, but they should be given four or five meals a day at regular, stated intervals, the number of meals and the food that they can safely be given, depending on their age and general health. For instance: children under thirteen years of age should not be given pies or pastry of any kind, coffee, tea, beer, cider, alcohol in any form, or soda water. Those under seven must not only be forbidden the articles mentioned above but also pork, ham, sausage, and other spiced meats, game, kidney, and liver, corn, beets, cabbage, cucumbers, raw vegetables other than green vegetables, hot bread, hot rolls, griddle cakes, nuts; while children under four years of age must be also forbidden corned beef, bacon, meat stews, tomatoes, berries, bananas, cherries, any kind of fruit in hot weather, and sweet cakes. Between the ages of twelve and eighteen months, almost the only foods a child should have in addition to milk are beef juice; orange juice; chicken, mutton, and veal broths; jellies of well cooked and well strained cereals; and sometimes, one or two pieces of zwieback, crackers, or toasted bread daily, and a soft cooked egg.

The Serving of Food

Some of the chief points to be considered in the serving of meals are:

1. To see that the dishes are clean, whole, in proper position on the tray, and that the latter is made to look as attractive as possible. A certain amount of appetite and secretion of the digestive juices are necessary for proper digestion, and these can be excited, to some extent, by pleasant odors and by an attractive and appetizing appearance in the food. On the other hand, badly served food will, by disgusting the patient, destroy his appetite, and interfere with the digestion of the meal.

2. Never serve too large an amount of food at one time, especially when the patient's appetite is poor. Not only does the sight of too much food often take away the little appetite he may have, but food served in small quantities and often will be digested better, when the functions of the digestive organs are impaired, than larger amounts taken at longer intervals.

3. Serve everything intended to be hot, hot, and cold things, cold. The serving rooms of the majority of modern hospitals are now equipped with steam tables, so that there is (in such, at any rate) no excuse for cold meals being served. Nurses, however, occasionally forget to turn on the steam, leave the windows open while preparing their trays, put the hot food on the trays before the cold, or use cold dishes. Such blunders are unpardonable. The food is often taken to the patient while he is receiving treatment and is not given him till the treatment is finished. He may also be obliged to wait for his food until a helpless patient who must be helped to eat has been given his. Miscalculations of this sort are likewise unpardonable.

In feeding a patient, always fold a table napkin or towel under his chin. When giving liquids, raise

his head slightly by slipping your arm under the pillow, but be careful not to throw his head forward on his chest, since this makes it difficult for him to swallow. Hollow glass tubes—drinking tubes—are superior, unless the patient is very weak, to the old-fashioned feeding cups for administering liquids. These tubes can easily be bent to any angle after they have been heated slightly. They should always be washed immediately after use. When a patient is delirious, it is often advisable to give him even his liquids with a teaspoon.

Diet in Disease

Anemia.—In anemia and other blood disorders, the diet should be particularly easy of digestion and rich in salts. Milk, eggs, rare beef, sweet fruit, and green vegetables should therefore be liberally supplied.

Cardiac Disease.—In cardiac disease if there is edema, it is sometimes necessary to limit the amount of liquid in the diet, an excess providing more fluid to escape into the tissue. In such case sodium chlorid must be withheld; the reason for this was stated on page 797. When the kidneys are involved the quantity of protein food must be limited and, under all circumstances, only carbohydrates and fats that are very easily digested may be used, for residue in the intestine is likely to give rise to flatulence. During an acute attack of cardiac trouble, the patient is usually kept on a milk diet.

Constipation.—In constipation, food likely to irritate and stimulate the intestinal tract should be given. Examples: oatmeal, wheaten grits, whole wheat bread, vegetables, and fruit. Plenty of water

should be drunk. Fatty meats, pastry, eggs, and milk puddings should be avoided.

Diabetes Mellitus.—In diabetes, owing to the incapacity of the system to oxidize as much glucose as usual, the amount of starches and sugars must be restricted to such quantity as it is possible for the system to oxidize. If a greater quantity of carbohydrate food is used than can be oxidized, the blood will be constantly surcharged with glucose, acids, and other products of imperfectly oxidized glucose, in consequence of which serious constitutional disturbances will arise. The amount of carbohydrate food that can be given depends upon the severity of the disease. Usually, in order to discover how much glucose the patient can utilize, all carbohydrate food is withheld for two or three days, and after this a small quantity is added to the diet. The amount is increased daily, until glucose appears in the urine. The quantity of carbohydrates then allowed in the diet will be just a little less than the amount which caused the presence of glucose in the urine. The urine is examined frequently, and the diet regulated according to the presence or non-presence of glucose. Since diabetic patients can have such a limited quantity of carbohydrate food, it is necessary for them to be given an unusually large supply of fat.

Foods Allowed in Diabetes.—The following foods are allowed in diabetes: meat soups and broths which are not thickened with any farinaceous substances; beef tea; all kinds of fish, meat, game, and poultry; eggs, gluten, almond, and bran bread, and cakes; string beans, green vegetables, tomatoes, mushrooms, oyster plant, radishes, pickles, and onions; custards, jellies, creams, walnuts, almonds,

filberts, Brazil nuts, cocoanuts, pecans, cherries, currants, strawberries, lemons, tea and coffee. All sweetening must be done with saccharine.

Foods to be Avoided in Diabetes.—The following foods should be avoided: liver, sugar, starches of any kind, beets, potatoes, carrots, turnips, peas, all fruit and nuts except those mentioned above, pastry, puddings, and sweet or sparkling wines and cordials.

Diarrhea.—During an acute attack of short duration, all food is withheld. If, however, the diarrhea is due to conditions that may exist for some time, such foods as boiled milk, whey, arrowroot, gruel, and milk soups are given in small amounts. As the symptoms abate, the diet can be slowly increased by the addition of farinaceous foodstuffs, scraped beef, broiled steaks, etc., but all rich foods and foods likely to irritate the intestinal tract, such as are purposely given in constipation, should be avoided.

Dyspepsia.—The most common causes of dyspepsia are: other diseases; food taken in large quantities, in improper proportions, at too frequent intervals, or too hastily swallowed; food that is in itself indigestible, or that has been rendered so by improper cooking or by being too highly seasoned. These errors must of course be guarded against in the treatment. Food must be taken in small quantities, at regular hours; it must be well masticated before being swallowed, and only such as can be easily digested must be allowed. All rich or highly seasoned dishes, fat meats (such as pork, goose, duck), all "cooked over" meats, or pickled meats and fish, fried food, game, crabs, lobster, sausages, candies, and articles of a like nature are to be avoided.

The following table of the comparative digestibility of food is given by several writers. The articles are mentioned in the order of their digestibility, beginning with that which is most so.

1. Oysters.
2. Toast.
3. Soft-cooked eggs.
4. Bread cereals and milk pudding.
5. Sweetbreads.
6. Whitefish, broiled or boiled.
7. Chicken, boiled or broiled.
8. Lean roast beef or steak.
9. Eggs, scrambled or omelet.
10. Mutton, roasted or boiled.
11. Squab, partridge, bacon.
12. Roast chicken, capon, turkey.
13. Tripe, brains, liver.
14. Roast lamb.
15. Chops, mutton or lamb.
16. Corned beef.
17. Veal.
18. Ham.
19. Duck, snipe, venison.
20. Rabbit.
21. Salmon, mackerel.
22. Herring.
23. Roast goose.
24. Lobsters, crabs.
25. Smoked, dried, or pickled fish and meat.

FEVER.—Formerly, it was thought that if food were given a patient while he had a high temperature his fever would be increased, because a larger supply of material would be provided for oxidation, but since the nature and causes of fever have become better

understood, it has been decided that food which can be properly digested and absorbed under existing circumstances will not cause a rise of temperature, and that if food is not supplied for oxidation the body tissues themselves will be consumed, therefore, in the treatment of fevers such as typhoid, which are likely to endure for some time, enough food is given to supply at least 3000 calories of heat a day. In choosing the food, two important conditions that exist when there is a high temperature are to be considered: (1) That the digestive juices, like all the other body secretions, are diminished in amount; (2) That the peristaltic action of the stomach and intestines is weak. Thus, it can be seen that only foods which are very easily digested can be used. Foods very generally used are milk, the caloric value of which is raised by the addition of lactose; junket, ice cream, custard, baked potatoes, egg albumin.

During convalescence from fever, the diet is extremely important, since both the conditions giving rise to the fever and the high temperature cause hemolysis of the red blood corpuscles and consequent anemia. See anemia, page 848.

Gastric Ulcer.—Formerly very little food was given by mouth to patients suffering with gastric ulcer, but as it has been lately demonstrated that the acidity of the gastric juice is increased by this treatment, and the ulcerative process favored by the hyperacidity, many physicians now feed their patients even after they have had hemorrhages.

The Lenhartz diet, in which the quantity of food is gradually increased, is a form of feeding frequently used.

Lenhartz Diet

Hours for Feeding.—Days one to ten, feeding every hour. Days eleven to fourteen, feeding every two hours. Feedings always omitted between 9 P.M. and 7 A.M. Water is allowed at intervals in moderate quantities.

Day 1. Egg drachms 2 and milk drachms 4 alternately.

Day 2. Egg drachms 3 and milk drachms 6 alternately.

Day 3. Egg drachms 4 and milk ounce 1 alternately, with sugar gms. 20 added to the egg.

Day 4. Egg drachms 5 and milk ounces 1½ alternately, with sugar gms. 20 added to the egg.

Day 5. Egg drachms 6 and milk drachms 14 alternately, with sugar gms. 30 added to the egg.

Day 6. Egg drachms 4 and milk ounces 2 alternately, with sugar gms. 40 added to egg, and scraped beef gms. 12 with three of the feedings.

Day 7. Egg drachms 4 and milk ounces 2 alternately, sugar gms. 40 added to the egg, scraped beef gms. 13 and rice gms. 3 with three feedings.

Day 8. Milk ounces 2½; feedings, otherwise, same as day 7.

Day 9. Egg drachms 4 and milk ounces 2 alternately, scraped beef gms. 13, rice gms. 6 with three feedings. Dried toast or zwieback gms. 20 with two feedings.

Day 10. Same as day 9, and in addition chopped chicken gms. 30 and butter gms. 20.

Day 11 to 14. Milk ounces 6, other feedings the same as day 10.

Nephritis.—As the kidneys excrete practically all

the protein waste, foods containing a large amount of this food element are to be restricted when these organs are diseased. A certain amount of protein will be necessary, in order to repair tissue waste; for, as already stated, muscular tissue cannot be formed from fats and carbohydrates. Sodium chlorid must be also withheld from the diet; the reason for this was given in the section on Nephritis, Chapter XXV.

During an attack of acute nephritis or exacerbation in a chronic form of the disease, a milk diet is usually prescribed and during convalescence such articles as are contained in the following list:

Vegetable, farinaceous, and fish soups; boiled or broiled fresh fish, raw oysters, clams, chicken, game, fat bacon, cereals of all kinds; cereal and milk puddings, stewed and raw ripe fruits. Tea and coffee are allowed if taken in small quantities and weak.

Rheumatism.—During an attack of acute rheumatic fever, milk and thin gruels usually constitute the principal articles of diet; broths and beef tea, especially the latter, are little used, since the extractives of the red meats give rise to a somewhat greater amount of nucleic acid than the majority of foods.

Individuals subject to attacks of rheumatism are generally cautioned against eating much red meat, berries, tomatoes, and sugar, and they are advised to drink as much water as possible.

The following diet is allowed in rheumatism: mutton and chicken broth and beef tea, in small quantities; raw clams, oysters, boiled fresh fish, chicken, sweetbread, boiled bacon; whole wheat, corn, or brown bread, toast, arrowroot, rice, green vegetables, fruits—except strawberries and bananas. All sweetening should be done with saccharine.

Rickets.—Rickets being in part due to a lack of fat and proteid food, these should be given in larger proportions and the amount of starchy food diminished. To young babies who are bottle-fed, give properly prepared milk. Avoid condensed milks and patented foods. To older children, give beef tea, mutton broth, eggs, milk, and fresh fruit juice, especially orange juice. If the child is old enough to have meat, give rare meat and vegetables.

Scurvy.—Scurvy is due to a lack of salts in the food. Therefore give fruit juices, especially lemon and orange, fruit, fresh vegetables, and meat.

Tuberculosis.—Tuberculosis is characterized by excessive tissue waste and anemia. Therefore, a liberal diet is necessary; in fact, the patient needs to be almost overfed. For this reason, it is very important that only very easily digested foods be given, and usually it is better to serve certain things, as raw eggs, milk, beef sandwiches, etc., between meals rather than have the patient eat a very large amount at mealtime. Fresh eggs form a particularly valuable article of diet, for they contain larger amounts of lecithin and iron than the majority of foods and their protein substances are easily digested.

CHAPTER XXVII

MASSAGE

THE "Swedish movement cure" was introduced into Sweden, in 1813, by Peter Henrik Ling, and was revised, in 1860, by Mezger of Amsterdam, but the movements which they practiced and taught were not original. Their fundamental principles were the same as those described in Chinese writings three thousand years earlier; the same as those used by the Brahmins of India, by the Egyptian priests, by Hippocrates, Galen, Rufus of Ephesus, and other physicians of ancient Rome and Greece, and by Hoffman and other noted physicians of the Middle Ages.

To be an expert masseuse requires a thorough knowledge of anatomy, and constant practice. The limited number of lessons in massage generally included in the curriculum of a nurse's course does not fit her to undertake the treatment of severe cases. The object of these lessons is simply to teach those elementary movements of massage which enter largely into the treatment of nervous diseases and of diseases requiring stimulation of the circulation, and which are employed where ankylosis of the joints is liable to complicate accident or disease.

Before taking up the study of massage, it is necessary to have a general idea of the anatomy of the

body, to know the position of the bones, the origin and insertion of the principal muscles, and the location of the larger arteries, veins, and nerves, and their functions.

Medical gymnastics, known variously as "Swedish movements," "movement cure," etc., is "a systematic exercise of the muscles and other tissues of the body for therapeutic purposes."

Some authors make a distinction between Swedish movements and massage, including under the former class the active movements, and under the latter the five primary passive movements. Others class all movements, both active and passive, under the heading of "medical gymnastics," thus:

Medical Gymnastics

Passive Movements.	1. Effleurage, or stroking	Massage.
	2. Petrissage, or kneading	
	3. Friction, or rubbing	
	4. Tapotement, or percussion	
	5. Pressure	
These Movements may be either Active or Passive.	6. Vibration	Swedish Movements.
	7. Circumduction	
	8. Rotation	
	9. Flexion	
	10. Extension	
Active Movements are either.	1. Assistive	
	2. Single or	
	3. Resistive	

Points to be Remembered

Massage must never be given without a doctor's order. Its use is counterindicated in all inflammatory conditions associated with pus, in skin diseases,

diseases accompanied with a rash, or parasitic diseases.

Before beginning a treatment, place the patient in a comfortable position, and sit in a comfortable position yourself, neither too far away from him nor too near him.

Always wash your hands before and after a treatment.

Lubricants may be used if desired, but, unless ordered for therapeutic purposes, these are not necessary unless the skin is dry. If the skin is moist it is often desirable to employ talcum powder.

In beginning a manipulation, use moderate force, increase the force gradually, and then, toward the end of the movement, decrease it as gradually.

Begin and end all treatment with effleurage.

Local treatment is given for from ten to twenty minutes.

General treatment is given for from half an hour to one hour.

Before giving local massage, loosen all bands around the part to be manipulated, and give effleurage and petrissage to the adjacent parts between it and the heart.

Always give effleurage, petrissage, and friction directly on the skin.

In general massage, the patient should wear a loose gown.

Never expose your patient.

Carry out a general treatment in the following order: legs, feet, arms, chest, abdomen, back.

EFFLEURAGE.—Effleurage is given from the periphery toward the heart. It may be given with the palms of one or both hands, or with the cushions of the fingers or thumbs.

EFFECTS.
- The superficial circulation is improved.
- Exudations are pushed along in the capillaries.
- The cutaneous nerves are soothed by light effleurage given for a short time, but are irritated by prolonged treatment.

Effleurage is given at the beginning and ending of all treatments.

PETRISSAGE.—Petrissage, or kneading, can be done with one hand or both hands, with the cushions of the fingers or of the thumb. The muscles are stretched away from the bone in the direction of the venous current, and the blood-vessels are alternately emptied and refilled by the alternate pressure and relaxation of the operator's hand while performing the movement.

In giving petrissage, begin above and work downward.

Never allow the hand to move on the skin. When one grasp of the muscle is thoroughly kneaded, relax the hand and take a new grasp, including a portion of the former one.

Use both hands whenever possible.

Make the greatest pressure while moving the muscle in the direction of the venous current.

EFFECTS.
- The circulation is improved.
- Blood pressure is diminished.
- Mental activity is lessened.
- The absorption of waste products is hastened.
- Nerves and muscles are strengthened.
- Swellings and effusions are reduced.
- Gentle petrissage stimulates tissue growth.
- Hard petrissage lessens tissue growth.

FRICTION.—Friction is given with the heel of the hand, the cushion of the thumb, or the fingers. To give friction, make small successive circles over the

prescribed area without moving the skin, exerting considerable pressure when not too painful. Always follow friction with efflcurage.

EFFECTS.
- The inflammatory products are broken up and moved on into the veins and lymphatics, thus hastening absorption.
- Local circulation is stimulated.

TAPOTEMENT.—Tapotement, or percussion, may be given with the ulnar edge of the hand, the palm of the hand, the tips of the fingers, or the closed hand. It is known, according to the method employed, as ulnar, palmar, digital, or fistic percussion. It may be given with one hand or both hands, and the application of the latter may be alternated or simultaneous.

- Ulnar percussion is generally used upon the back.
- Palmar (simultaneous), on the extremities.
- Fistic (either alternate or simultaneous), on the glutei.
- Digital (either alternate or simultaneous), on the head.

EFFECTS.
- Moderate percussion causes contraction of the blood-vessels.
- Moderate percussion increases the irritability of the nerves.
- Moderate percussion applied across muscles increases their contractibility.
- Prolonged percussion causes the dilatation of the blood-vessels.
- Prolonged percussion causes temporary paralyzation of the nerves.
- Prolonged percussion applied across muscles will loosen contraction.

PRESSURE.—Pressure is given with the cushion of the fingers or with the knuckles, and usually follows the course of nerves or vessels.

EFFECTS.
- Pressure is sedative in neuralgic pains.
- Pressure causes local paralyzation of muscle.
- Pressure causes secondary increase of circulation.

Pressure should be used only by those thoroughly instructed in anatomy.

VIBRATION.—To give vibration, grasp the part to which vibration is to be given between the hands, fix your arms firmly and hold them stiffly, producing a tremor in them which will be transmitted to the part of the body between your hands.

EFFECTS.
- Vibration produces stimulation in palsies.
- Vibration acts as a counter-irritant.
- Vibration produces changed nutrition.

CIRCUMDUCTION.—Circumduction may be either passive or active.

In circumduction, "some part of the body is made to describe with its longitudinal axis the surface of an imaginary cone." The circle is made as large as the joint permits. Large limbs are moved slowly, small ones more quickly.

EFFECTS.
- Blood is drawn from the moving extremity.
- Absorption is increased.
- Tendons, etc., are made more pliable.
- Articular adhesions are broken up.

ROTATION, FLEXION, ETC.—The names describe the movements. The effects are those of assistive or resistive movements in a less marked degree.

ACTIVE MOVEMENTS.—Active movements are either single, assistive, or resistive.

Single movements are those performed by the patient and constitute the movements of educational gymnastics.

In assistive movements the operator helps the patient.

In resistive movements the operator resists the patient.

These movements should be given slowly and evenly.

EFFECTS.	Coördination is increased. The circulation is improved. Absorption is hastened. Metabolism is improved. Nutrition is improved. Adipose tissue is lessened. Muscular tissue is hardened. Adhesions are broken up. Joints are made more pliable.

REFERENCE BOOKS

BACTERIOLOGY

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Bacteria, Yeasts, and Moulds in the Home. CONN.
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Bacteria in Daily Life. FRANKLAND.
Bacteriology. HISS and ZINSSER.
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Immunization. WRIGHT.

CHEMISTRY

Elementary Study of Chemistry. MCPHERSON and HENDERSON.
Elementary Chemistry. GODFREY.
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